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ON THE RELATIONSHIP OF CONDITION OF THE TEETH IN CHILDREN TO FACTORS OF HEALTH AND HOME ENVIRONMENT

BY
E. C. RHODES, B.A. CANTAB.
GALTON LABORATORY, UNIVERSITY OF LONDON

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PREFATORY NOTE.

THE existence of various theories as to the sources of defective teeth in children—many supported by little or no statistical demonstration—suggested to the members of the Galton Laboratory the great importance of a fuller investigation of the relations between the condition of teeth in children and (i) their general health, (ii) their home environment, and (iii) the goodness or badness of the teeth of their parents.

It would seem at first sight that something of value with regard to (i) might be learnt from the ordinary schedules of school medical inspection. Such schedules, however, contain very little information with regard to (ii); indeed, only such information as can be obtained indirectly from the employment or status of the father, and the cleanliness of body and clothes of the children themselves. With regard to (iii) nothing, of course, could be ascertained in this way. When, however, we came to study the matter, great difficulties arose even with regard to (i); the records of the teeth are only a few of many entries which the medical officers have to make in a very hurried manner owing to the demands on their time; there is, further, very little attempt to standardise the various medical inspectors who worked in approximately the same areas, and we were rapidly convinced that, until such standardisation takes place, differences, not only in teeth, but in various factors of children's health, will be attributed to environment when they are really due to the personal equation of the assistant school medical officers.

With the object, therefore, of obtaining fuller and more reliable data, not only as to the teeth, but as to eyes, clothing, and other matters, the Galton Laboratory obtained permission for two medical men, its own nominees, to assist in the medical inspection of a large school. The data thus obtained are being reduced at the present time. While these school investigations were in progress "visitors" selected by the

Laboratory called at the homes of the children and were able to obtain fairly comprehensive details of the home environment. Thus some material was collected, if not as complete as we could desire, with regard to both (i) and (ii).

We next turned our attention to (iii), and the most suitable locus for such investigations appeared to be a dental clinic to which mothers were in the habit of bringing their children for dental advice, and where it would be possible to some extent to observe both child and parent. Unfortunately the war intervened before these investigations were completed, but a considerable number of schedules were filled in, and it is hoped that some day further material may be obtained from the same or another clinic.

While these investigations were in progress we came across the Report to the Blankshire County Council of the School Medical Officer for 1912. As it contained what were clearly more ample dental records than are usually made in school medical inspections, we asked permission to examine the original schedules, and it is this material which is analysed in the present memoir. The purpose of this first paper on the condition of the teeth in children will be adequately fulfilled if it demonstrates that there is a wide field in which there is room for valuable co-operation between an institute like ours established for research purposes, and a municipal executive having to make for practical ends a very rapid survey of its child population and having little if any leisure for research.

There are many urgent practical problems which could be adequately solved by a study of the child population of this country, but they can only be solved by the leisurely laboratory method of observation, by standardised judgments and an efficient training in modern statistical methods. At present the observations are too rapid to be of great scientific value, the judgments are personal opinions rather than real measures of fact, and the statistical methods of school officers' reports rarely indicate a knowledge extending beyond the elementary rules of arithmetic. These results are not due to any fault of the medical officers themselves, but to the inadequate system under which they are trained for their work, and to the speed under which they are compelled to form their record.

K. P.

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ON THE RELATIONSHIP OF THE CONDITION OF THE TEETH IN CHILDREN TO FACTORS OF HEALTH AND HOME ENVIRONMENT.

THE data analysed in this paper were collected by the School Medical Officers of the Blankshire County Council, in 1911, and for permission to use them I must thank heartily the Senior School Medical Inspector. In addition I have found much helpful information in the Annual Reports prepared by him which have been kindly sent to the Galton Laboratory. I am greatly indebted to Miss E. A. Jones for the saving of much labour in the preparation of the Tables used. Miss E. M. Elderton has allowed me to make use of work done some years ago on the correlation between Teeth and Weight, and has throughout this paper helped me with much friendly advice. Professor Karl Pearson has supervised the work of the whole paper, and I wish to thank him for his many helpful suggestions and kind encouragement during the past months. My thanks are also due to Miss L. de M. Carey and Miss I. McLearn for the diagrams prepared by them to illustrate the work in the following pages.

I. INTRODUCTION: THE DATA.

For the purposes of School Medical Inspection the whole county was divided into five districts, there being five Medical Inspectors, each of whom took one district and examined all the children in that area. In this paper we shall hereafter refer to the five doctors as D 1, D 2, D 3, D 4, D 5, and their allocation to the various regions was as follows:—

Mid-West.	Mid-East.	North.	South-East.	South-West.
D 1	D 5	D 3	D 4	D 2

From the first annual report of the School Medical Inspector for 1908, we find that these areas can roughly be classified as follows: The Middle region is practically entirely agricultural, the North is a decidedly hilly country, where the people are partly occupied with mining and partly with sheep farming in the moorlands, the South Western area and the South Eastern area contain the coal mines and iron foundries for which the county is noted, and most of the larger towns lie in the South Western area. All the doctors, however, had a mixed population of town and country children to deal with, and these two populations are differentiated with regard to age, since the leaving ages of children in urban schools and rural schools are not exactly the same.

The children inspected were those of ages 4-5 ; 8-9 ; 12-14 years. And as the chief purpose of this paper is to find any connection between the state of the teeth and other characters dealt with in the medical inspection, those children in the last age group only were considered, for by the time they had attained the age of 12 years it was assumed that they would have no longer any milk teeth.* Consequently our data is immediately divided into two groups, one dealing with children attending urban schools where they are examined after they attain 13 years, and the other dealing with children attending rural schools where they are examined after they reach the age of 12 years. In the former group, as the inspection is spread over the whole year, the ages of the children inspected range from 13 to 14 years and the mean age is 13½ years : similarly, in the latter group the mean age is 13 years. Henceforth we shall refer to these two groups of children as B 13½, G 13½ ; B 13, G 13, the abbreviations B and G standing for boys and girls respectively, and we shall be understood to mean that any 13½ group is from an urban school population and any 13 group from a rural school population.

As D 1 had very small 13½ groups, the totals being only in the region of 10, these have been entirely neglected in this work.

Primarily the data were examined with special reference to the condition of the teeth, but as it was found that the data could be treated from other points of view, this was done and the results are given here.

II. GROUPING THE DATA.

The total numbers of the children examined by each doctor and their distribution in the respective age and sex groups are shown in the accompanying table, together with the geographical and economic distinctions.

	B 13.	G 13.	B 13½.	G 13½.	Total.		
D 1	143	190	16	10	359	Mid-west	Rural
D 2	150	179	252	280	861	South-west	Town
D 3	257	239	221	248	965	North	Mixed
D 4	295	313	263	243	1114	South-east	Mixed
D 5	360	337	241	212	1150	Mid-east	Rural
Total .	1205	1258	993	993	4449		

A consideration of the numbers of children examined by each doctor, set out in the above table, shows how desirable it is that we should be able to group all the doctors together and work with four sets of data, one for each of the sex and age groups B 13, G 13, B 13½, G 13½, for with totals of 1205, 1258, 993, 993, we should get much smaller probable errors of our means, standard divisions and correlation coefficients than with the individual totals of each doctor. Our first object, therefore, must be to test the distributions given by each doctor for each group of children, in order to discover whether the data can be grouped together and if not, to find which doctors we may combine. In order to obviate any possible personal equation affecting the results, we make our test on the distribution of the children examined by each doctor for weight and height, because these measurements should be invariable from one district to another and the records were taken by persons other than the doctors, so that there is no question of personal equation entering into the distributions.

---

* Actually some children were found with carious milk teeth.

As we wish to find out if the various districts have the same type of population and, therefore, may be grouped together, we start by testing whether two given distributions are random samples of the same population on the 8-9 year groups, because the total numbers of children in these groups are in the region of 1000, a much larger number than those involved in the later groups of 13½ and 13 which we are to consider in these pages. If we find that as a result of this test on 8-9 groups we can or cannot group together two districts as being similar samples from the same population, we are justified in accepting or rejecting such combinations for our groups of older children.

We have, then, these results for the B 8-9 distributions.

B 8-9. Probability of the distributions being random samples from the same population, all possible pairs being taken.

	D 1, D 2.	D 1, D 3.	D 1, D 4.	D 1, D 5.	D 2, D 3.	D 2, D 4.	D 2, D 5.	D 3, D 4.	D 3, D 5.	D 4, D 5.
Height distributions .	·0000	·12	·005	·64	·0000	·01	·0000	·40	·16	·0005
Weight distributions .	·0000	·15	·02	·42	·0000	·081	·0000	·09	·68	·005

When we consider this table of chances, looking first at those obtained for height distributions, we are inclined to accept as possible combinations the distributions of D 1 and D 5, D 3 and D 4, and D 3 and D 5, and to reject all the other combinations as not being probable. Turning now to the lower row of probabilities, those obtained from the weight distributions, we see that according to these figures the combination of D 3 and D 5 together is now more possible, and that the probability of D 3 and D 4 being samples of the same population is much reduced, being ·09, while those obtained from comparing the distributions of D 4 and D 1, D 4 and D 2, and D 4 and D 5 are increased. We will deal with these two points in turn. First, the question of D 3 and D 5 being a possible combination—we see that D 1 and D 5 divide between them the middle region of the county, which is described as mainly agricultural, and that apparently D 1 has that district in which there are very few urban schools, because the numbers of children of the 13½ groups returned for this doctor being only twenty-six altogether, while D 5 examines more equal numbers of rural and urban children. On the other hand, the region inspected by D 3 in the North has a mixed population similar to that examined by D 5. We must reject the possibility of all three doctors being combined together owing to the low values obtained when D 1 and D 3 are compared. From the geographical distribution we should anticipate that these three groups would show such possibilities, but remembering that the middle region is mainly flat and agricultural, whereas the northern region is more hilly and the inhabitants are occupied in mining and sheep farming—we are inclined to combine D 1 and D 5 and reject the possibility of combining D 3 and D 5. By this arrangement, the rural schools of the former group would be all combined together, and they represent a farming community. Also the 13½ groups of this combination will be entirely those of D 5 and will represent an urban population of small towns in the pleasant central area of Blankshire. Whereas if we combined D 3 and D 5 we should have a rural population, some of which were from the sheep farms and the hills, and the rest from the more general farms of the middle region, and an urban population, composed of the mining towns of the North and the more rural small towns of the middle region. In order to test this arrangement a comparison was made of the distributions of weight returned by D 3 and D 5 for B 4-5 which gave a probability of only ·02, so we finally rejected this combination and decided to combine D 1 and D 5.

Secondly, with regard to the curious lack of agreement between the probabilities in the above table in cases where D 4 is concerned, we made a further test on the distributions of B 4-5 with these results:—

	D 4, D 3.	D 4, D 2.
Height distributions	·35	·001
Weight distributions	·14	·21

Again we have the same thing occurring—that D 3, D 4 is a possible combination from a comparison of the distributions of height, but that the probability is less when we consider the weight distributions, and further that the probability of D 4 and D 2 being combined is for weight but not for height a possibility. The same was found when we compared the distributions of G 8-9 with these results:—

	D 4, D 3.	D 4, D 2.
Height distributions	·19	·0001
Weight distributions	·014	·16

When we consider what may have given rise to this anomaly, the possibility arises that the weights given for the D 4 district may be in error by a constant amount owing to a defect in the weighing machine used, for this machine was carried about from school to school. The mean weights of the children in D 3's area are greater than those in D 2's area, and if the weights returned by D 4 were all less than they actually should be by a small amount, then we can see that the probability of D 3, D 4 being a possible combination would be decreased, while the probability of the D 4, D 2 combination would be increased.

The mean weights and heights for the different groups in the D 3 and D 4 regions were found, and are shown below with the differences between the corresponding groups.

We have the following mean values for the various age and sex groups :—

	Mean Heights (Inches).		Difference (3-4).		Mean Weights (Lbs.).		Difference (3-4).	
	D 3.	D 4.			D 3.	D 4.		
B 4-5	42·052	41·915	·14 ± ·06	·21 ± ·045	41·046	40·447	0·60 ± ·15	·8 ± ·11
G 4-5	41·994	41·662	·33 ± ·07		40·264	39·238	1·03 ± ·15	
B 8-9	48·237	47·916	·32 ± ·09	·20 ± ·06	53·540	52·500	1·04 ± ·25	·7 ± ·18
G 8-9	47·876	47·803	·07 ± ·09		51·341	51·083	0·26 ± ·25	
B 13	55·664	55·498	·17 ± ·17	·32 ± 0·9	75·635	74·025	1·61 ± ·60	1·9 ± ·33
G 13	56·406	56·307	·10 ± ·18		76·882	76·639	0·24 ± ·68	
B $13\frac{1}{2}$	56·384	55·795	·58 ± ·18		78·812	75·293	3·52 ± ·64	
G $13\frac{1}{2}$	57·061	56·612	·48 ± ·18		81·765	79·099	2·67 ± ·80	

We see that whereas the differences between the means of the groups examined by D 3 and D 4 are barely significant when compared with the probable errors in the height distributions, yet these differences are significant when we consider the weight distributions and are persistently of the same sign.

Consequently we are led to the following proposition :—

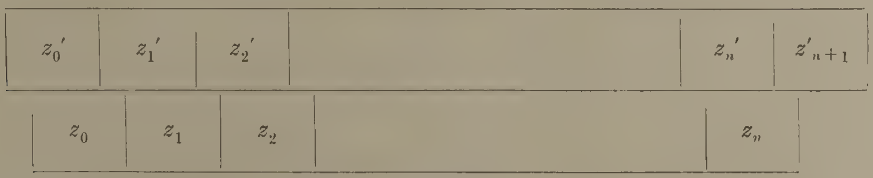
Given two distributions, which are samples from the same population—in one distribution the scale has been altered by a constant amount, how can we find the error thus introduced ?

Consider the two populations given :—

$$y_0\ y_1\ y_2\ \cdot\quad\cdot\quad\cdot\ y_n\quad \text{total N}$$
$$z_0\ z_1\ z_2\ \cdot\quad\cdot\quad\cdot\ z_n\quad \text{total N}'.$$

We are to alter the second distribution by altering the scale by a constant amount and get a new distribution.

$$z_0'\ z_1'\ z_2'\ \cdot\quad\cdot\quad\cdot\ z_n'\quad \text{total N}'.$$



If we assume that the scale is too low by an amount m units where m is < 1 then we have these values for z_0' z_1', etc., in terms of z_0 z_1, etc.

$$
\begin{aligned}
z_0' &= z_0 - m\frac{(2z_0 + 5z_1 - z_2)}{6} + \frac{m^2}{2}(z_1 - z_0) \\
z_1' &= z_1 - \frac{m}{2}(z_2 - z_0) + \frac{m^2}{2}(z_2 - 2z_1 + z_0) \\
z_2' &= z_2 - \frac{m}{2}(z_3 - z_1) + \frac{m^2}{2}(z_3 - 2z_2 + z_1) \\
& \quad . \quad . \quad . \quad . \quad . \quad . \\
z'_{n-1} &= z_{n-1} - \frac{m}{2}(z_n - z_{n-2}) + \frac{m^2}{2}(z_n - 2z_{n-1} + z_{n-2}) \\
z'_n &= z_n - \frac{m}{2}(3z_n - 4z_{n-1} + z_{n-2}) + \frac{m^2}{2}(z_n - 2z_{n-1} + z_{n-2}) \\
z'_{n+1} &= \frac{m}{6}(11z_n - 7z_{n-1} + 2z_{n-2}) - \frac{m^2}{2}(2z_n - 3z_{n-1} + z_{n-2}).
\end{aligned}
$$

where we assume that m^3 is sufficiently small to be neglected, and that the frequency curve of the distribution can be represented with sufficient accuracy as the combination of a series of parabolas.

Now this distribution $z_0'\ z_1' \ldots z_n'\ z'_{n+1}$ must be comparable with $y_0\ y_1 \ldots y_n$ and these two distributions should be random samples from the same population. The usual procedure is to find

$$\sum_0^{n+1} \frac{\left(\frac{y_r}{\mathrm{N}} - \frac{z_r'}{\mathrm{N}'}\right)^2}{y_r + z_r'} . \mathrm{N} . \mathrm{N}' = \chi^2 \text{ (say).}$$

For a given number of classes into which the distributions are arranged, the smaller this function is, the greater is the probability that instead of having the distribution given by the y's we had obtained the distribution given by the z''s. Consequently we require to choose m so that the above is a minimum.

$$\text{Now} \qquad \chi^2 = \sum_0^{n+1} \frac{(\mathrm{N}'y_r - \mathrm{N}z_r')^2}{\mathrm{NN}'(y_r + z_r')} = \sum_0^{n+1} \frac{[\mathrm{N}'y_r - \mathrm{N}(z_r - m\alpha_r + m^2\beta_r)]^2}{\mathrm{NN}'(y_r + z_r - m\alpha_r + m^2\beta_r)}$$

where $\alpha_r . \beta_r$ are the coefficients of m and m^2 in the expressions above for $z_0'\ z_1' \ldots$ i.e.

$$
\begin{aligned}
\alpha_r &= \tfrac{1}{2}(z_{r+1} - z_{r-1}) \text{ for } r = 1, 2 \ldots n - 1 \\
\alpha_0 &= \frac{2z_0 + 5z_1 - z_2}{6} \\
\alpha_n &= \frac{3z_n - 4z_{n-1} + z_{n-2}}{2} \\
\alpha_{n+1} &= -\frac{11z_n - 7z_{n-1} + 2z_{n-2}}{6}, \text{ etc.}
\end{aligned}
$$

we can put χ^2 in the form

$$\sum_0^{n+1} \frac{\{(\mathrm{N}' + \mathrm{N})y_r - \mathrm{N}(y_r + z_r - m\alpha_r + m^2\beta_r)\}^2}{\mathrm{NN}'(y_r + z_r - m\alpha_r + m^2\beta_r)}$$

$$\text{i.e.} \quad \sum_0^{n+1}\left[\frac{\mathrm{N}}{\mathrm{N}'}(y_r + z_r - m\alpha_r + m^2\beta_r) - 2\frac{\mathrm{N} + \mathrm{N}'}{\mathrm{N}'}y_r + \frac{(\mathrm{N} + \mathrm{N}')^2 y_r^2}{\mathrm{NN}'(y_r + z_r - m\alpha_r + m^2\beta_r)}\right].$$

Now this is to be a minimum, and we have the condition, found by differentiating with respect to m.

$$\sum_{0}^{n+1}\left\{\frac{\mathrm{N}}{\mathrm{N}'}(-\,a_r + 2m\beta_r) + \frac{(\mathrm{N}+\mathrm{N}')^2 y_r^2(a_r - 2m\beta_r)}{\mathrm{N}\mathrm{N}'(y_r + z_r - ma_r + m\beta_r)^2}\right\} = 0$$

i.e. we have
$$\sum_{0}^{n+1}\frac{y_r^2(a_r - 2m\beta_r)}{(y_r + z_r - ma_r + m^2\beta_r)^2} = \sum_{0}^{n+1}\frac{\mathrm{N}^2}{(\mathrm{N}+\mathrm{N}')^2}(a_r - 2m\beta_r)$$

$$= \frac{\mathrm{N}^2}{\mathrm{N}+\mathrm{N}'^2}\,\frac{1}{6}\left\{(z_n - 2z_{n-1} + z_{n-2}) - (z_2 - 2z_1 + z)\right\},\ \text{for } \overset{n+1}{\underset{0}{\Sigma}}\beta_r = 0.$$

We have this equation from which to find m, and the approximate values of m obtained from the weight distributions given by D 3 and D 4 for B 8-9, B 4-5, and G 8-9—when we alter the scale of D 4's distributions, are:—

B 8-9 . . . . . . $m = \cdot 4$
B 4-5 . . . . . . $m = \cdot 2$
G 8-9 . . . . . . $m = \cdot 2$

As our working unit is 3 lbs. this means that roughly, the D 4 distributions are 0·6 lbs. different in scale from those of D 3. That is to say the machine used in the D 4 district is weighing ½ lb. too low. If then we take this as an approximation to the actual facts, we find that we get new distributions for the cases considered which when compared with D 3 give the following probabilities of the two distributions being samples from the same population, which we can compare with those obtained originally with the D 3, D 4 distributions as given:—

	P.		P.
B 8-9	·26	B 8-9	·09
B 4-5	·47	B 4-5	·14
G 8-9	·05	G 8-9	·014

If we now compare these new D 4 distributions with the given D 2 distributions we have these values for the probability which we can compare with those obtained before:—

	New P.	Old P.
B 8-9	·04	·081
B 4-5	·06	·21
G 8-9	·12	·16

We see then that this assumption of wrong scale in the D 4 weight distributions, gives us results which conform more closely with the results obtained from the height distributions than originally was the case. The only doubtful case is that of G 8-9, where the improvement resultant upon the change in the scale is not nearly so great as in the other two cases. We are led then to the combination of D 3 and D 4 and to reject all other possible combinations. We are the more inclined to adopt this grouping as, although the districts are geographically at opposite ends of the county, yet the type of population seems to be somewhat the same in both of them, containing both urban and rural elements. There is no justification, as we have seen, for combining D 2 with any of the other doctors.

We shall attempt, therefore, in this work to combine the data given by D 1 and D 5 and that given by D 3 and D 4. We consider that although we have made our tests of sampling on data other than that actually examined later in the paper, we are justified in this step, in spite of the fact that an examination of the distributions of children of 13 and $13\frac{1}{2}$ would show that practically all the doctors could be grouped together owing to the smaller frequencies involved. As an illustration of this we have the table below.

When we examine the height and weight distributions for B 13, we have the following values of the probability of the possible combinations being random samples from the same population:—

B 13.

	D 1, D 2.	D 1, D 3.	D 1, D 4.	D 1, D 5.	D 2, D 3.	D 2, D 4.	D 2, D 5.	D 3, D 4.	D 3, D 5.	D 4, D 5.
Height . .	·36	·32	·60	·45	·91	·96	·64	·89	·34	·11
Weight . .	·68	·68	·46	·53	·73	·46	·44	·55	·71	·29

We see from such an examination that we could take any combination of the doctors and consider that the distributions given by them were all random samples from the same population.

We must point out that we have made the tests above on the weight and height distributions in order to find out which districts have sensibly the same type of population, but that when we come to the consideration of the distributions of the various districts for teeth, nutrition, etc., we must examine the distributions given by the different doctors for any possible differences due to different methods adopted by the doctors in their diagnoses.

III. TEETH DISTRIBUTIONS.

(i) Considering now the teeth distributions given by the various doctors which represent the numbers of children in the various groups with perfect teeth and those having one, two, three, etc., teeth carious, we note immediately that all the doctors with one exception, D 4, finish up their tale of bad teeth with a group described as "several," meaning several teeth carious, but unfortunately all the doctors do not, mean the same thing by "several" and individual doctors vary the meaning of "several" in the examination of the different age and sex groups. In consequence, we are faced with the necessity for departing from the quantitative grouping of 0, 1, 2, . . . teeth carious, to such indefinite groupings as Perfect, Moderate (1 and 2 carious), and Bad (3 and more carious); or even into two classes Good (including Perfect and 1 carious); and Bad, including the rest.

The following table shows how the different doctors distribute the teeth in the various groups of children.

	Pf.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Several.	Total.
D 1—														
B 13	24	26	34	24	15	5	4	.2					9	143
G 13	33	40	58	17	22	9	3						8	190
B 13½	6	3	3	2		1							1	16
G 13½	0	1	7	1	1									10
D 2—														
B 13	15	26	49	20	19	8	6		2				5	150
G 13	45	27	43	28	15	5	1	4	2				9	179
B 13½	76	42	53	27	12	14	2	2					24	252
G 13½	76	50	73	36	18	8	6	1					12	280
D 3—														
B 13	60	37	95	36	18	1							10	257
G 13	66	36	80	25	24								8	239
B 13½	49	28	84	27	19								14	221
G 13½	58	49	64	25	25								27	248
D 4—														
B 13	60	77	80	36	26	11	3	1	1					295
G 13	65	66	87	42	28	15	8	1	1					313
B 13½	55	64	65	45	14	12	6	1	1					263
G 13½	45	50	68	43	19	9	6	1			1		1	243
D 5—														
B 13	64	36	25	7		1						1	226	360
G 13	61	38	34	7	5	1							191	337
B 13½	36	21	16	3									165	241
G 13½	25	19	22	6	1								139	212

From this table we have then these possible meanings of the group "several" as interpreted by the five doctors:—

Doctor.	"Several."
D 1	more than 7.
D 2	more than 8.
D 3	more than 5.
D 4	more than 10.
D 5	more than 5.

This divergence of opinion amongst the several doctors drive us from the numerical grouping of the distribution to the grouping in categories—good, bad, etc.

Further examination of this table shows us other divergencies between the distributions. First, the sizes of the "several" groups in D 5's distributions are out of all proportion to the sizes of the "several" groups of the other doctors. Secondly, the groupings of the various doctors in the first three categories (Pf, 1, 2) are different as is seen in the accompanying table, and we are forced to the conclusion that the doctors have all different standards upon which they base their judgments of bad teeth ; so that although our material allows us to combine D 3, D 4 ; D 1, D 5

	Pf.	1.	2.
D 1	Increasing to a maximum.		
D 2	Maximum.	Minimum.	Maximum.
D 3	Maximum.	Minimum.	Maximum.
D 4	Increasing to a maximum.		
D 5	Maximum, then decreasing.		

we are unable to do this for any discussion of teeth on account of the divergences in the doctors' distributions of teeth.

(ii) We can see this still further when we analyse the teeth distributions and find the means and standard deviations. To do this we must proceed as follows :—

Being obliged to group the teeth in non-numerical divisions, we chose three : Pf : 1, 2 : Rest, i.e. taking the perfect group as one of our three groups, combining 1 and 2 groups into our new middle group, and combining all the other groups into one end group. From the distribution as given by these three groups we can find the mean and standard deviation of each distribution, for the width of the middle group in teeth units is 2, and we can express this from Sheppard's Tables in terms of the σ of the distributions, and having found σ, we can find the distance of the mean from the division line between the first group (Pf) and the middle group (1, 2).

We have the following results :—

	B 13.		G 13.		B 13½.		G 13½.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
D 1	1·73549	1·60204	1·35480	1·38164	—	—	—	—
D 2	1·65369	1·22711	1·30110	3·08976	1·03604	2·07329	1·02829	1·71227
D 3	1·09486	1·43750	0·91406	1·55263	1·10909	1·47044	1·22293	1·64562
D 4	1·19312	1·41763	1·18594	1·48907	1·22148	1·50068	1·37838	1·51230
D 5	3·38860	3·69740	2·79728	3·10795	3·84057	3·60705	3·47605	2·95085

and make the following observations on the above table :—

(*a*) We have assumed that the distributions are normal in each case in order to get the means and standard deviations (S.D.'s). We return to this point later.

(*b*) We have not included in the above the few cases examined by D 1 of B 13½ and G 13½.

(*c*) Of the pairs of doctors which may be taken together D 3 and D 4 have means and standard deviations which are not very different. Roughly the probable error of the means given by D 3 and D 4 is ± ·06, and of the standard deviations ± ·04, but the means and standard deviations of D 1 and D 5 are very different. The probable errors of the means of D 5 are roughly ± ·13 and of D 1 ± ·09.

(*d*) The means and standard deviations of D 5 are so widely different from the others that D 5 must have had an entirely different method of teeth examination from the other doctors. When we examine this point further, we find that in the Annual Report for 1908 on "special" cases, i.e. those cases examined by the doctors which are not in the routine years and which are presented by the teachers or picked out by the doctor after the routine inspection has taken place, there is the following paragraph (p. 25); "D 5's 'specials' were more numerous proportionately than those of the other inspectors. This was owing to the fact that D 5's schools were nearly all small country schools with few children. There was, therefore, plenty of time after examining the routine cases, to go round the classes and pick out the 'specials' for herself." This inclines one to the view that, if D 5 had sufficient time after the routine inspection to examine a great number of extra cases, that she had time during the routine inspection to examine the mouth carefully and report on it more fully than the other doctors, consequently presenting distributions which give the average child twice or thrice as many bad teeth as the other doctors. Later, when we attempt to compare the doctors, we shall therefore take D 5 as the standard and find the differences between this doctor and the others.

Although we should be justified *a priori* in combining certain of the doctors and thus have larger frequencies to deal with, since the children examined by these doctors are sensibly of the same type as judged by weight and height, yet these combinations are impossible in dealing with carious teeth owing to the different distributions of teeth given by the individual doctors. Consequently we lose the great advantage of dealing with a large number of cases, and in any discussion of teeth we must deal with several sets of data each having total frequencies in the region 200-300. In correlating teeth with other characters we take each doctor's data separately and find 18 correlation coefficients or ratios each having a large probable error. Having obtained these we can obtain a weighted mean from them and thus get some measure of correlation between various characters for the whole county. The results obtained would have more weight owing to the smaller probable errors involved when larger frequencies are under consideration, if the doctors had had a common standard of judgment of various characters, and we had been able to put together at least some of the data which they obtained.

(iii) We return now to the question of the teeth distributions being Gaussian or normal, which has been assumed to be the case when we found the means and standard deviations above. Actually an examination into the distribution given by D 4 for B 13, which does not contain a "several" category, shows us that this particular distribution is not normal, but on the contrary is decidedly skew, being best fitted by a Type I. Pearson Curve of limited range. The equation to which is

$$y = 86{\cdot}389\left(1 - \frac{x}{15{\cdot}127}\right)^{11{\cdot}819}\left(1 + \frac{x}{1{\cdot}607}\right)^{1{\cdot}256}.$$

This curve is shown in the diagram, together with the given distribution in the form of a histogram.

The theoretical frequencies were obtained from this curve and the theoretical

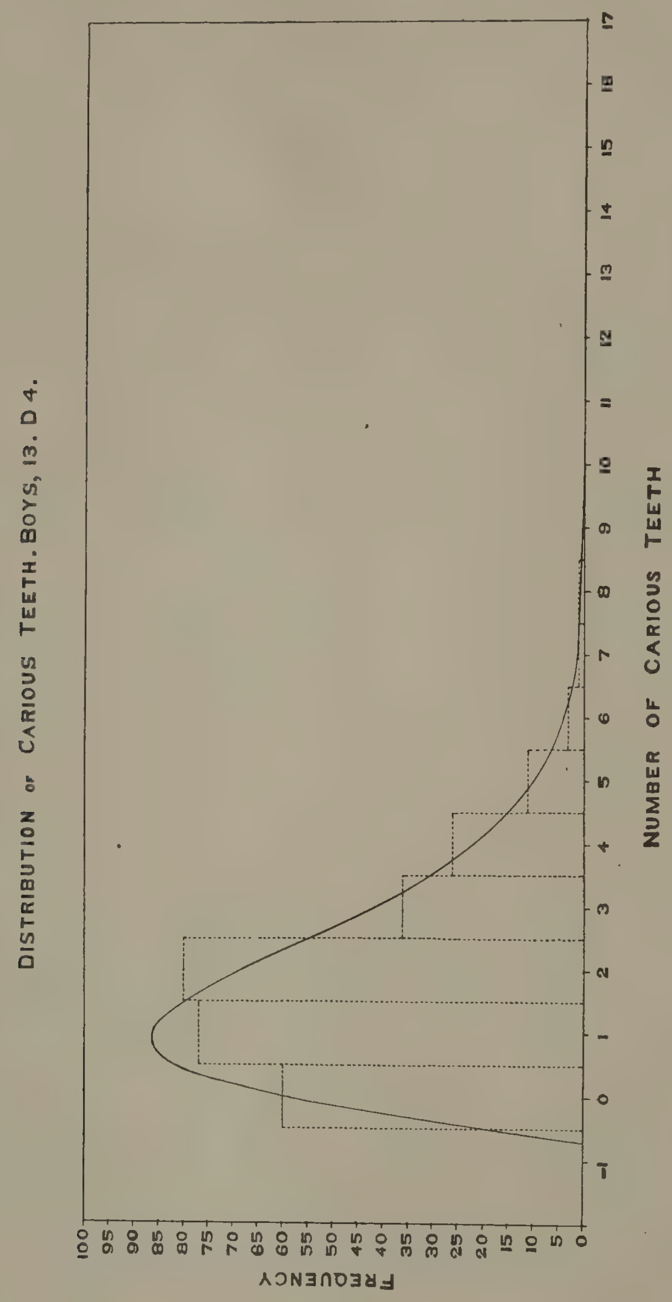


Diagram I.

frequencies given by the Gaussian which would fit the data best were obtained from Sheppard's Tables. These are set out below and compared with the actual frequencies observed.

No. of Carious Teeth.	– 3.	– 2.	– 1.	Pf.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Theoretical (Skew)	—	—	—	61·1	84·0	67·5	42·6	22·7	10·2	4·3	1·5	1·1	295
Observed . .	—	—	—	60	77	80	36	26	11	3	1	1	295
Gaussian . .	0·5	3·3	14·0	38·2	67·4	77·0	56·9	27·3	8·5	1·7	0·2	0·0	295

It will be seen that the skew curve shows more agreement with the observed distribution than the Gaussian, and the result of goodness of fit tests made to compare these, emphasises this, for we obtain probabilities of ·95 when comparing the skew with the observed and ·003 for the other case, and we see that the Gaussian does not fit well the observed data.

We should hardly anticipate for boys aged 13 years, whose teeth are new and therefore probably less carious than the teeth of older boys, that the distribution would be normal. We should anticipate that the distribution would be more normal at a later age. Owing to the fact that the other doctors introduce the indefinite term "several" into their distribution of teeth, we can only consider the teeth distributions in indefinite groups and work out means, standard deviations, and later correlation coefficients, using the methods which would apply were the distributions actually Gaussian. We fully recognise, however, the assumption made.

(iv) We now turn to the association between carious teeth and the weight of the child.

We first form a table for each of the age and sex groups for each doctor, making 18 in all, having the teeth in two groups Good and Bad, the Good group consisting of those given by the doctors as Perfect and 1 tooth carious, and the Bad group consisting of the remainder. The weights are distributed into several groups, each group having a range of 3 lbs. such a group being $52\frac{7}{8}$-$55\frac{7}{8}$ lbs., the mean of this group being at $54\frac{3}{8}$ lbs. We take the limits of each group at $\frac{1}{8}$ lb. intervals because the actual weights were taken to the nearest $\frac{1}{4}$ lb. and such grouping obviates any difficulties which might arise as to the frequency of a certain weight falling partly into one group and partly into another. If we had taken our limits from 53-56 lbs., in the particular instance above, this might have occurred.

The "biserial *r*" method was used and we obtained the correlation coefficients (see next page).

We note that these correlation coefficients are all positive in the case of boys, but that they are either not significant or are doubtful; that in the case of girls they are positive and negative, only two being sufficiently large to be just significant. We see then that there is practically no correlation between teeth and weight in any of the 18 cases considered above, and the weighted mean of all these small correlation coefficients is itself less than three times its probable error, so that we may say that the Blankshire data, considered as a whole, shows no correlation which is significant between teeth and weight for school children of 12 to 14 years; and regarding weight as some guide to health we may assert that the data examined shows no correlation of any importance between the state of the teeth and the health of the child.

TABLE OF CORRELATION COEFFICIENTS BETWEEN TEETH AND WEIGHT.

(+ sign indicates that better teeth and greater weight are found together.)

	B 13.	G 13.	B $13\frac{1}{2}$.	G $13\frac{1}{2}$.
D 1	+ ·2254 ± ·0766 †	− ·0387 ± ·0696 *	—	—
D 5	+ ·1290 ± ·0478 †	+ ·0081 ± ·0492 *	+ ·0973 ± ·0611 *	− ·0512 ± ·0672 *
D 3	+ ·0919 ± ·0552 *	+ ·1150 ± ·0563 †	+ ·0153 ± ·0594 *	− ·0244 ± ·0568 *
D 4	+ ·1490 ± ·0517 †	− ·1819 ± ·0497	+ ·0624 ± ·0529 *	− ·1281 ± ·0556 †
D 2	+ ·0716 ± ·0940 *	+ ·2646 ± ·0837	+ ·0776 ± ·0540 *	+ ·0727 ± ·0513 *

Mean r, weighting each value according to its P.E., is + ·0381 ± ·0136.

Although we were handicapped by not being able to group some of the data together and thus obtain a result which was based on a frequency of about 1000, yet when we find that separately the correlation coefficients are all small and doubtful, we can draw our conclusions as above with as much reliance as we should have been able to do, if it had been possible to combine our data as originally we had hoped.

(v) We pass now to the fundamental problem of this paper.

(*a*) We shall attempt to find expressions for the personal equations of the doctors from their distributions of teeth. Here we must remember that D 1 and D 5 take random samples from the same population and D 3 and D 4 also take random samples from another population, so that we can at most compare D 1 and D 5 together and D 3 and D 4 together.

Consider D 3, D 4.

We will assume that they take a sample from the same population given by

$$z = \frac{Ne^{-\frac{1}{2}x^2/\sigma^2}}{\sqrt{2\pi}\,.\,\sigma}, \text{ a normal distribution}$$

and that they then distort the distribution in some way, so as to produce another mean and another standard deviation.

Let us assume that the distribution given by D 3 for B 13 is

$$z = \frac{Ne^{-\frac{1}{2}x^2/\sigma_3^2}}{\sqrt{2\pi}\sigma_3}$$

and that the distance of the mean from the division line (O) between perfect and 1 carious tooth is m_3.

Then the equation of the distribution referred to O as origin is

$$Z = \frac{1}{\sqrt{2\pi}} \frac{Ne^{-\frac{1}{2}(x-m_3)^2/\sigma_3^2}}{\sigma_3}.$$

$^*r < 2 \times$ P.E. † r between 2 and 3 × P.E.

Now suppose that in order to reduce this distribution given by D 3 to the original distribution of the population from which the sample was taken, we need only expand or compress the units of teeth represented along the axis Ox. That is to say, let us put $X = \lambda_3 x$ and $Z = z/\lambda_3$ since the total frequency is unaltered and we have the distribution given as

$$Z = \frac{1}{\lambda_3} \frac{Ne^{-\frac{1}{2}((X/\lambda_3)-m_3)^2/\sigma_3^2}}{\sqrt{2\pi}\sigma_3} = \frac{Ne^{-\frac{1}{2}(X-\lambda_3 m_3)^2/\lambda_3^2\sigma_3^2}}{\sqrt{2\pi}\sigma_3\lambda_3}.$$

Now if this is the equation to the original distribution, the original S.D. is $\lambda_3\sigma_3$ and the original mean, measured from the division line between perfect and 1 carious tooth is $\lambda_3 m_3$. Let us try this hypothesis, assuming in the case of D 3 a stretching of the x-unit represented by λ_3 and in the case of D 4 a stretching represented by λ_4. Let us denote the means and S.D.'s of the populations from which the samples were taken according to the following table:—

	S.D.	Mean.
B 13	σ	m
G 13	σ'	m'
B 13½	σ''	m''
G 13½	σ'''	m'''.

We know the means and S.D.'s of the distributions given by D 3 and D 4, so we shall get the following system of equations:—

$$\begin{array}{lll}
\text{B 13} & 1{\cdot}09486\,\lambda_3 - m = 0 & 1{\cdot}19312\,\lambda_4 - m = 0 \\
 & 1{\cdot}43750\,\lambda_3 - \sigma = 0 & 1{\cdot}41763\,\lambda_4 - \sigma = 0 \\
\text{G 13} & 0{\cdot}91406\,\lambda_3 - m' = 0 & 1{\cdot}18594\,\lambda_4 - m' = 0 \\
 & 1{\cdot}55263\,\lambda_3 - \sigma' = 0 & 1{\cdot}48907\,\lambda_4 - \sigma' = 0 \\
\text{B 13}\tfrac{1}{2} & 1{\cdot}10909\,\lambda_3 - m'' = 0 & 1{\cdot}22148\,\lambda_4 - m'' = 0 \\
 & 1{\cdot}47044\,\lambda_3 - \sigma'' = 0 & 1{\cdot}50068\,\lambda_4 - \sigma'' = 0 \\
\text{G 13}\tfrac{1}{2} & 1{\cdot}22293\,\lambda_3 - m''' = 0 & 1{\cdot}37838\,\lambda_4 - m''' = 0 \\
 & 1{\cdot}64562\,\lambda_3 - \sigma''' = 0 & 1{\cdot}51230\,\lambda_4 - \sigma''' = 0
\end{array}$$

There are 16 equations and we desire to find λ_3, λ_4, m, m', m'', m''', σ, σ', σ'', σ'''. That is to say, there are 9 unknown ratios. We find the best value of these ratios by means of the principle of least squares; they are:—

$$\begin{array}{ll}
\lambda_3 = {\cdot}766343\,m''' & \lambda_4 = {\cdot}743634\,m''' \\
m = {\cdot}86314\,m''' & \sigma = 1{\cdot}07791\,m''' \\
m' = {\cdot}79119\,m''' & \sigma' = 1{\cdot}14858\,m''' \\
m'' = {\cdot}87914\,m''' & \sigma'' = 1{\cdot}12141\,m''' \\
m''' = m''' & \sigma''' = 1{\cdot}19285\,m'''.
\end{array}$$

We have in λ_3 and λ_4 a means of comparing D 3 and D 4, for if we take D 4 as standard and assume $\lambda_4 = 1$, we have immediately $\lambda_3 = \frac{{\cdot}766343}{{\cdot}743634} = 1{\cdot}030538$ and the means and S.D.'s of the original populations from which D 3 and D 4 drew their samples are as below. These may be compared with the given means and S.D.'s of D 4.

	Mean.	S.D.	Mean D 4.	S.D. D 4.
B 13 . . .	1·1607	1·4495	1·1931	1·4176
G 13 . . .	1·0639	1·5445	1·1859	1·4891
B 13½ . . .	1·1822	1·5080	1·2215	1·5007
G 13½ . . .	1·3447	1·6041	1·3784	1·5123

Let us then apply this stretch λ_3 to the actual means and S.D.'s given by D 3 and we have—

	Mean.	S.D.
B 13	1·1283	1·4814
G 13	0·9420	1·6000
B 13½	1·1430	1·5153
G 13½	1·2603	1·6959

We may compare these also with the calculated means and S.D.'s of the supposed original population. Now the probable errors of the means and S.D.'s calculated from the given data are :—

	D 3.		D 4.	
	P.E. Mean.	P.E. S.D.	P.E. Mean.	P.E. S.D.
B 13 .	± ·0869	± ·0716	± ·08471	± ·0679
G 13 .	± ·0937	± ·0840	± ·08541	± ·0707
B 13½ .	± ·0946	± ·0790	± ·08979	± ·0750
G 13½ .	± ·1031	± ·0849	± ·09791	± ·0806

Thus the P.E.'s of the means and S.D.'s of the original population which are given above and which have been calculated as shown by solving certain equations by the methods of least squares, will be at least about ± ·10 and ± ·10. Comparing then the three tables of means and S.D.'s above, viz. of the original population, of D 4 and of D 3 modified by λ_3, and bearing in mind the size of the probable errors, we see that the differences between these three tables are not very great and we may infer that such stretching as is given by λ may represent the necessary change to make in D 3's distributions in order to reduce them to the standard of D 4.

To consider what λ means in terms of the distribution given by D 3, let us obtain, from the table of means and S.D.'s of D 3 after λ_3 has been applied, new distributions of the teeth in the three categories, Perfect : 1, 2 : the Rest, and compare these with those given by D 3, before any application of λ has taken place.

We have from the ratio $\frac{\text{mean}}{\text{S.D.}}$ the number in the "Perfect" category, and since the original mean and original S.D. are each multiplied by λ this ratio is unchanged and we still have the same number of cases in the first category; and

Further, since the breadth of the middle category is 2, we have from the ratios $\frac{2-\text{mean}}{\text{S.D.}}$ the numbers in the "Rest" class : thus we obtain the whole distribution, as below :—

	2 − mean.	$\frac{2-\text{mean}}{\text{S.D.}}$	$\frac{1}{2}(1+\alpha)$.	Total.	"Rest" Category.
B 13	·87171	·58844	·72188	242	67·31
G 13	1·05803	·66125	·74577	223	56·69
B 13½	·85704	·56558	·71416	213	60·88
G 13½	·73972	·43619	·66865	223	73·89

We have then these distributions—the supposed original distribution and that given by D 3 :—

B 13.				G 13.				B 13½.				G 13½.			
Pf.	1·2.	Rest.	T.	Pf.	1·2.	Rest.	T.	Pf.	1·2.	Rest.	T.	Pf.	1·2.	Rest.	T.
54	120·69	67·31	242	62	104·31	56·69	223	48	104·12	60·88	213	51	98·11	73·89	223
54	124	64	242	62	107	54	223	48	107	58	213	51	101	71	223
Difference	+3·31	−3·31			+2·69	−2·69			+2·88	−2·88			+2·89	−2·89	

From this table we see that D 3 compared with D 4 underestimates the number of carious teeth in the mouth and in consequence has slightly too many cases in the middle category and the same number too few in the "Rest" category. The percentages of the numbers placed in the wrong category to the total numbers examined are :—

B 13.	G 13.	B 13½.	G 13½.
1·37 per cent.	1·21 per cent.	1·35 per cent.	1·30 per cent.

so that we see roughly 1·3 per cent. of D 3's cases are placed in the wrong class and we could use this as a means of reducing teeth distributions given in future by D 3 to the same scale as that used by D 4, and when this has been done we could combine data given by D 4 and D 3.

We know that D 1 and D 5 take their samples from the same population. Let us then attempt to combine these two doctors as we combined the teeth distributions of D 3 and D 4.

We will denote the means and S.D.'s of the supposed original population, as follows :—

	Mean.	S.D.
B 13 . . .	M	Σ
G 13 . . .	M'	Σ'
B 13½ . . .	M''	Σ''
G 13½ . . .	M'''	Σ'''

Calling λ_1, λ_5 the stretching coefficients applied to D 1 and D 5 distributions respectively in order to reduce them to the original we shall get these equations :—

$$\begin{array}{lll}
\text{B 13 .} & 3{\cdot}38860\lambda_5 - M = 0 & 1{\cdot}73549\lambda_1 - M = 0 \\
. & 3{\cdot}69740\lambda_5 - \Sigma = 0 & 1{\cdot}60204\lambda_1 - \Sigma = 0 \\
\text{G 13 .} & 2{\cdot}79728\lambda_5 - M' = 0 & 1{\cdot}35480\lambda_1 - M' = 0 \\
 & 3{\cdot}10795\lambda_5 - \Sigma' = 0 & 1{\cdot}38164\lambda_1 - \Sigma' = 0 \\
\text{B } 13\tfrac{1}{2} \text{ .} & 3{\cdot}84057\lambda_5 - M'' = 0 & \\
 & 3{\cdot}60705\lambda_5 - \Sigma'' = 0 & \\
\text{G } 13\tfrac{1}{2} \text{ .} & 3{\cdot}47605\lambda_5 - M''' = 0 & \\
 & 2{\cdot}95085\lambda_5 - \Sigma''' = 0 &
\end{array}$$

Obtaining the best values of our unknowns from these equations we have :—

$$\lambda_1 = 2{\cdot}133259\lambda_5$$

$$\begin{array}{llll} M & = 3{\cdot}54543\lambda_5 & \Sigma & = 3{\cdot}55748\lambda_5 \\ M' & = 2{\cdot}84371\lambda_5 & \Sigma' & = 3{\cdot}02767\lambda_5 \\ M'' & = 3{\cdot}84057\lambda_5 & \Sigma'' & = 3{\cdot}60705\lambda_5 \\ M''' & = 3{\cdot}47605\lambda_5 & \Sigma''' & = 2{\cdot}95085\lambda_5 \end{array}$$

We can now compare D 1 and D 5, for if we assume D 5 is the standard then $\lambda_5 = 1$ and we have

$$\lambda_1 = 2{\cdot}133259 \text{ and}$$

$$\begin{array}{lllll} \text{B } 13 \ . \ . & M & = 3{\cdot}5454 & \Sigma & = 3{\cdot}5575 \\ \text{G } 13 \ . \ . & M' & = 2{\cdot}8437 & \Sigma' & = 3{\cdot}0277 \\ \text{B } 13\tfrac{1}{2} \ . \ . & M'' & = 3{\cdot}8406 & \Sigma'' & = 3{\cdot}6071 \\ \text{G } 13\tfrac{1}{2} \ . \ . & M''' & = 3{\cdot}4760 & \Sigma''' & = 2{\cdot}9508 \end{array}$$

which are the means and S.D.'s of the original population from which D 5 and D 1 drew their samples.

We must compare these with the means and S.D.'s of the distributions given by D 5 and with those of the new distributions obtained by applying to D 1's distributions the λ_1 obtained above.

	D 5.		D 1.	
	Mean.	S.D.	Mean.	S.D.
B 13 . .	3·3886	3·6974	3·7022	3·4176
G 13 . .	2·7973	3·1079	2·8901	2·9474
B 13½ . .	3·8406	3·6071	—	—
G 13½ . .	3·4761	2·9509	—	—

Now the probable errors of the means and S.D.'s given by D 5 and D 1 are:—

	D 5.		D 1.	
	Mean.	S.D.	Mean.	S.D.
B 13 . .	± ·1966	± ·2953	± ·1527	± ·1219
G 13 . .	± ·1691	± ·2265	± ·1129	± ·0865
B 13½ . .	± ·2524	± ·3728	—	—
G 13½ . .	± ·2283	± ·2939	—	—

and the probable errors of the means and S.D.'s given above for the supposed original population will be at least of the order of ± ·20 and ± ·20, and we see that the differences between the means and S.D.'s in the tables above for the original population and for D 5 and D 1 modified by λ_1 are not unreasonable.

We note that whereas when we compared D 3 and D 4 the ratio of λ_3 to λ_4 was nearly unity, indicating that there was little difference between the judgments of teeth given by these two doctors, yet when we compare D 5 and D 1, we get the ratio of λ_5/λ_1 to be 2 roughly, indicating that D 1's judgment of teeth differs from D 5's judgment by a considerable amount. We will now investigate this point further and attempt to translate λ_1/λ_5 into a simpler meaning of the difference between D 1 and D 5.

Let us then give the D 1 distributions the stretch λ_1 and find the new distributions corresponding to the means and S.D.'s we obtain in this way. We have:—

	Mean.	S.D.
B 13 . .	3·7022	3·4176
G 13 . .	2·8901	2·9474

The ratio $\frac{\text{mean}}{\text{S.D.}}$ will give us the number of cases in the "Perfect" category which will be the same as before since λ multiplies both the given mean and given S.D. to get the mean and S.D. of the original population. To get the numbers in the "Rest" category we take $\frac{2-\text{mean}}{\text{S.D.}}$:—

	2 − mean.	$\frac{2-\text{mean}}{\text{S.D.}}$.	½ (1 + α).	Number.	Rest Category.
B 13 . .	− 1·7022	− ·4981	·3092	122	84·28
G 13 . .	− ·8901	− ·3020	·3813	153	94·66

Thus we have:—

	B 13.				G 13.			
	Pf.	1·2.	Rest.	Total.	Pf.	1·2.	Rest.	Total.
Original distribution	17	20·72	84·28	122	25	33·34	94·66	153
Given distribution .	17	52	53	122	25	79	49	153
Difference . .		+ 31·28	− 31·28			+ 45·66	− 45·66	

That is to say compared with D 5, D 1 greatly underestimates the number of carious teeth in the mouth with the result that too many cases are placed in the middle category by this doctor and too few in the "Rest" category, the percentages of cases which are thus transferred being:—

B 13 . . .	25·64 per cent.
G 13 . . .	29·84 ,, ,,

the mean of which is 28 per cent.

Thus the result of D1's under-estimate of the number of carious teeth in any child's mouth means that roughly 28 per cent. of the cases returned as having carious teeth at all are placed in the wrong class. We could use this figure to transfer any teeth data given by D 1 to the same standard as D 5, so that we could combine these two doctors' data.

Let us return to p. 18, and now take $\lambda_1 = 1$.

If we equate λ_1 to 1 and compare D 5 with D 1 we now get:—

B 13 . . $M = 1{\cdot}6620$ $\Sigma = 1{\cdot}6676$
G 13 . . $M' = 1{\cdot}3330$ $\Sigma' = 1{\cdot}4193$
B 13½ . . $M'' = 1{\cdot}8003$ $\Sigma'' = 1{\cdot}6909$
G 13½ . . $M''' = 1{\cdot}6295$ $\Sigma''' = 1{\cdot}3833$

The means and S.D.'s of the distributions from which D 5 and D 1 are supposed to have drawn their samples.

We shall compare with these the means and S.D.'s of the given distributions when they are modified by λ_5 and λ_1; we get as new means and S.D.'s for the D 5 distributions :—

	Mean.	S.D.
B 13 . . .	1·5885	1·7332
G 13 . . .	1·3113	1·4569
B 13½ . .	1·8003	1·6909
G 13½ . .	1·6295	1·3833

and for D 1 distributions :—

	Mean.	S.D.
B 13 . . .	1·7355	1·6020
G 13 . . .	1·3548	1·3816

so that we see these figures for the original given distributions conform very closely to the figures we have obtained on our hypothesis for the actual means and S.D.'s of the population from which the two doctors have sampled. We proceed as before to find the numbers of cases in the three teeth categories for the D 5 distributions :—

	2 − Mean.	$\frac{2 - \text{Mean}}{\text{S.D.}}$.	$\frac{1}{2}(1 + \alpha)$.	Number.	Rest Category.
B 13 . .	·4115	·2374	·5938	345	140·13
G 13 . .	·6887	·4727	·6818	326	103·73
B 13½ . .	·1997	·1181	·5470	223	101·02
G 13½ . .	·3705	·2679	·6056	201	79·27

and we have :—

	B 13.				G 13.			
	Pf.	1·2.	Rest.	Total.	Pf.	1·2.	Rest.	Total.
Original distribution	62	142·87	140·13	345	60	162·27	103·73	326
Given distribution .	62	60	223	345	60	70	196	326
Difference . .		− 82·87	+ 82·87			− 92·27	+ 92·27	

	B 13½.				G 13½.			
	Pf.	1·2.	Rest.	Total.	Pf.	1·2.	Rest.	Total.
Original distribution	32	89·98	101·02	223	24	97·73	79·27	201
Given distribution .	32	36	155	223	24	38	139	201
Difference . .		− 53·98	+ 53·98			− 59·73	+ 59·73	

That is to say compared with D 1, D 5 greatly over-estimates the number of carious dentures with the result that too many cases occur in the "Rest" category and too few in the middle category, representing cases with slight caries. The percentages of cases thus transferred being :—

B 13.	G 13.	B 13½.	G 13½.
24·0 per cent.	28·3 per cent.	24·2 per cent.	29·2 per cent.

so that roughly 26·4 per cent. of cases are transferred in this way. This is practically the same figure as was obtained when we compared D 1 with D 5 as standard, and obtained the percentage of cases transferred by D 1.

Again, we could use this figure above to transfer any teeth data given by D 5 to the standard used by D 1.

We see from the above that D 5 compared with D 1 greatly over-estimates the number of carious teeth. This seems hardly likely, and we must look further for the cause of the discrepancy between these two doctors. We note, then, that in the above we have assumed that all the doctors mean by "Several" 3 carious teeth and more, because we have included the "Several" cases in the "Rest" category of the distributions. It may be that D 5 has used "Several" on occasions to indicate the presence of two carious teeth or possibly one carious tooth. We shall investigate this further when we try to find out what actually is meant by "Several".

(*b*) Proceeding with the discussion on the above results we see that in the case of the D 5 and D 1 combination, which represents a rural population, the means are in the neighbourhood of 3·5 when we regard D 5 as the standard, and in the case of the other combination D 3 and D 4, which represents a mining and industrial population the means are in the neighbourhood of 1·2. Now we should not anticipate that there would be any great difference between the means of these two types and must conclude that the standards we have taken D 5 and D 4 respectively are widely different in their returns of the number of carious teeth. When we use D 1 as the standard in our first combination we see that the means are in the neighbourhood of 1·5 which is more in agreement with the results obtained from the D 3 and D 4 combination. From this we would infer that D 1 should be taken as the standard in the first group in preference to D 5, and inquiry reveals the fact that in the medical inspection for 1911, three doctors D 1, D 3, and D 4 arranged to hold a more detailed inspection of the mouths, reporting discoloration, uncleanness, etc., in addition to caries. We shall refer to the matter later when discussing the association between cleanliness of the teeth and caries. This fact leads us, then, to take D 1 as the standard in the first combination, since the figures given by this doctor are probably the result of more careful examination of the teeth, and D 5's distributions as given must be modified by assuming that the number of carious teeth is over-estimated or we must conclude that we have been wrong in assuming that this doctor denotes by "Several" three or more carious teeth. As the first alternative seems rather impossible we shall investigate the D 5 distributions on the assumption that "Several" in this case means one, two, or more carious teeth. This alternative also appears artificial, in so far that it does not seem likely that a doctor would describe a case as having several carious teeth when only one was in that condition, but we will work with the data on this assumption and compare the results with the previous results obtained on the other assumptions. When we look again at the original teeth distributions we see that we must modify our first idea of what the various doctors meant by "Several".* We have supposed that "Several" meant any number of teeth beyond the highest number returned by the doctor in any distribution. Thus D 1 returns, in the B 13 distribution, two cases having seven carious teeth and we assumed that "Several" meant eight or more, and similarly with the others. But closer inspection of these distributions reveals the fact that it is really impossible to attach this meaning to the numbers returned as "Several," and especially is this the case with D 5. To the tail of a distribution of teeth such as :—

0.	1.	2.	3.	4.	5.
64	36	25	7	—	1

we cannot fit 227 cases starting at six teeth, and we are driven to the conclusion that these 227 cases must include some with two carious teeth and possibly some with one carious tooth. Similarly with D 1 and D 2; we must conclude that "Several" includes cases of five and more carious teeth. With the D 3 distributions we can assume quite reasonably that "Several" means five and more. Such modifications of our impression of the meaning of "Several" will not invalidate the previous work where we have taken the teeth as divided into three categories (because in effect in this work we have assumed that "Several" may mean three and more), except in the case of D 5, and here we see the reason why on our previous assumption the means and S.D.'s for the D 5 distributions were so widely different from those of the other distributions. Again when comparing D 5 and D 1 we said, taking D 1 as standard, that we must take out some of the cases from D 5's "Rest" categories and put them in the middle categories, which is equivalent to saying that our tacit assumption that D 5 means by several three or more, must be modified and must mean two or more, or possibly one or more. If we agree to assume that in this case "Several" includes cases of two carious teeth only, we may just as reasonably go one step further and assume that "Several" also includes some cases of one carious tooth.

So far we conclude then, on the evidence before us that we were wrong to suggest D 5 as the standard in the first combination, that the returns of D 1, D 3, and D 4 are probably the best since these doctors made a more careful investigation of the state of the mouth; that the mean number of carious teeth for children of these ages under consideration is in the region of 1·4 (we see that we get figures of the same order in the D 2 distributions), that the standard deviations of the distributions are all in the neighbourhood of 1·5, that D 5 means by "Several" one or more carious teeth, and that D 1, D 2, and D 3 mean by "Several" five or more carious teeth. We cannot get any reasonable comparison between the different types of population as represented by the various combinations because there is apparently no consistent change from B to G groups or from 13 to 13½ groups as the table shows.

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* Inquiries made recently, i.e. 10 years after the original observations, were not successful in throwing any light on the meaning of "Several".

	D 1, D 5 Combination.		D 3, D 4 Combination.		D 2.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
B 13 . . .	1·66	1·67	1·16	1·45	1·65	1·23
G 13 . . .	1·33	1·42	1·06	1·54	1·30	3·09
B 13½ . . .	1·80	1·69	1·18	1·51	1·04	2·07
G 13½ . . .	1·63	1·38	1·34	1·60	1·03	1·71

These results are, of course, obtained on the assumption that the distributions are approximately normal or Gaussian.

When we examine the table of the teeth distributions for the various age and sex groups given by the different doctors, we see immediately that a difficulty arises in the interpretation of the "Several" groups which occur in these distributions. We shall attempt to find out what each doctor means by "Several," using the knowledge we have already obtained, that the data given by D 1 and D 5 can be combined and that the data given by D 3 and D 4 can also be combined.

(1) *D* 1 *and D* 5.—We see from the distributions that it is fair to assume that D 1 has used the word "Several" to indicate in certain cases children who have five or more teeth carious, and that D 5 has used the word in a different sense, viz. to indicate cases which occur of one or more teeth carious. We shall assume that this is the case. We shall also assume that each doctor is consistent in taking the same proportions from each group to form the "Several" group. We shall have then the following distributions given by D 5:—

	Pf.	1.	2.	3.	4.	5.	6.	7.
B 13	64	$36 + 227\lambda_1$	$25 + 227\lambda_2$	$7 + 227\lambda_3$	$227\lambda_4$	$1 + 227\lambda_5$	$227\lambda_6$	$227\lambda_7$
G 13	61	$38 + 191\lambda_1$	$34 + 191\lambda_2$	$7 + 191\lambda_3$	$5 + 191\lambda_4$	$1 + 191\lambda_5$	$191\lambda_6$	$191\lambda_7$
B 13½	36	$21 + 165\lambda_1$	$16 + 165\lambda_2$	$3 + 165\lambda_3$	$165\lambda_4$	$165\lambda_5$	$165\lambda_6$	$165\lambda_7$
G 13½	25	$19 + 139\lambda_1$	$22 + 139\lambda_2$	$6 + 139\lambda_3$	$7 + 139\lambda_4$	$139\lambda_5$	$139\lambda_6$	$139\lambda_7$

where λ_1, λ_2, etc., are to be determined.

We shall have the distributions given by D 1 :—

	Pf.	1.	2.	3.	4.	5.	6.	7.	8.
B 13	24	26	34	24	15	$5 + 9\mu_5$	$4 + 9\mu_6$	$2 + 9\mu_7$	$9\mu_8$
G 13	33	40	58	17	22	$9 + 8\mu_5$	$3 + 8\mu_6$	$8\mu_7$	$8\mu_8$

where the μ's are to be determined.

We find the λ's and μ's by the method of least squares assuming that the distributions of these two doctors are random samples from the same population. As D 1 only deals with B 13 and G 13 we can only use these two of the distributions to find our λ's and μ's.

Let us consider the distribution B 13. Divide the frequency in each group by the total: we have :—

	Pf.	1.	2.	3.	4.	5.	6.	7.
D 5	·1778	$\cdot 1000 + \cdot 6306\lambda_1$	$\cdot 0694 + \cdot 6306\lambda_2$	$\cdot 0194 + \cdot 6306\lambda_3$	$\cdot 6306\lambda_4$	$\cdot 0028 + \cdot 6306\lambda_5$	$\cdot 6306\lambda_6$	$\cdot 6306\lambda_7$
D 1	·1678	·1818	·2378	·1678	·1049	$\cdot 0350 + \cdot 0629\mu_5$	$\cdot 0280 + \cdot 0629\mu_6$	$\cdot 0140 + \cdot 0629\mu_7$

When finding the probability that these two distributions are samples from the same population, we take the differences in the above series, we square these differences, etc., and obtain a χ^2. This χ^2 must be small in order that the two distributions shall belong to the same population, so that we get equations for λ's and μ's by considering that these differences are as small as possible and actually assuming them to be zero. We then have these equations :—

$$\cdot 6306\,\lambda_1 = \cdot 0818\,;\ \cdot 6306\,\lambda_2 = \cdot 1684\,;\ \cdot 6306\,\lambda_3 = \cdot 1484\,;\ \cdot 6306\,\lambda_4 = \cdot 1049\,;$$
$$\cdot 6306\,\lambda_5 - \cdot 0629\,\mu_5 = \cdot 0322\,;\ \cdot 6306\,\lambda_6 - \cdot 0629\,\mu_6 = \cdot 0280\,;$$
$$\cdot 6306\,\lambda_7 - \cdot 0629\,\mu_7 = \cdot 0140\,;\ \cdot 6306\,\lambda_8 - \cdot 0629\,\lambda_8 = 0, \text{ etc.}$$

We get similar equations when we consider in the same way the distributions of carious teeth for G 13. They are :—

$$\cdot 5668\,\lambda_1 = \cdot 0977\,;\ \cdot 5668\,\lambda_2 = \cdot 2044\,;\ \cdot 5668\,\lambda_3 = \cdot 0687\,;\ \cdot 5668\,\lambda_4 = \cdot 1010\,;$$
$$\cdot 5668\,\lambda_5 - \cdot 0421\,\mu_5 = \cdot 0444\,;\ \cdot 5668\,\lambda_6 - \cdot 0421\,\mu_6 = \cdot 0158\,;$$
$$\cdot 5668\,\lambda_7 - \cdot 0421\,\mu_7 = 0\,;\qquad \cdot 5668\,\lambda_8 - \cdot 0421\,\mu_8 = 0, \text{ etc.}$$

At present there is no limit fixed to the number of λ's and μ's.

We remember that

$$\lambda_1 + \lambda_2 + \lambda_3 + \ldots = 1$$
$$\mu_5 + \mu_6 + \mu_7 + \ldots = 1$$

so that our λ's and μ's must be such that they fulfil these conditions.

We find actually when we get the best λ's and μ's to satisfy these equations that we have :—

$\lambda_1 = \cdot 1513$ $\mu_5 = \cdot 9250$
$\lambda_2 = \cdot 3089$ $\mu_6 = \cdot 0750$
$\lambda_3 = \cdot 1847$ and λ_7, λ_8, etc. $= 0$
$\lambda_4 = \cdot 1716$ μ_7, μ_8, etc. $= 0$.
$\lambda_5 = \cdot 1582$
$\lambda_6 = \cdot 0253$

Using these λ's and μ's to interpret the "Several" categories of D 5 and D 1 we see that we have :—

TEETH DISTRIBUTIONS.

B 13.	Pf.	1.	2.	3.	4.	5.	6.	7.	Totals.
D 5 .	64	70·3	95·1	48·9	38·9	36·9	5·7	—	359·8
D 1 .	24	26	34	24	15	13·3	4·7	2	143

The probability *P* obtained by using the test that these distributions should be random samples from the same population is ·36 which indicates that so far the method assumed above is justifiable since it does conform with previous experience on the height and weight distributions.

G 13.	Pf.	1.	2.	3.	4.	5.	6.	7.	Totals.
D 5 .	61	66·9	93·0	42·3	37·8	31·2	4·8	—	337
D 1 .	33	40	58	17	22	16·4	3·6	—	190

For girls *P* is ·9 ; which again helps to justify the method used.

Using the same λ's we can obtain the distributions for D 5, B 13½, G 13½ :—

D 5.

	Pf.	1.	2.	3.	4.	5.	6.	Totals.
B 13½	36	46	67	33·5	28·3	26·1	4·2	241·1
G 13½	25	40	64·9	31·7	24·9	22	3·5	212

We will note here that these distributions are all definitely skew.

We proceed to obtain the means and S.D.'s of these distributions separately with the following results :—

	D 5.		D 1.	
	Mean.	S.D.	Mean.	S.D.
B 13 . .	2·1720 ± ·0566	1·5934	2·0007 ± ·0988	1·7521
G 13 . .	2·1240 ± ·0576	1·5682	2·0979 ± ·0765	1·5633
B 13½ . .	2·2787 ± ·0685	1·5775		
G 13½ . .	2·3373 ± ·0700	1·5102		

If we now combine these figures we obtain means which will represent the mean number of carious teeth in children in the rural region in the middle of the county. They are :—

B 13	2·1233 ± ·0491
G 13	2·1708 ± ·0460
B 13½	2·2787 ± ·0685
G 13½	2·3373 ± ·0700

and it will be seen that the means in each age group are greater for girls than for boys, and though the differences are not actually significant yet they may be of some importance since they exist for both age groups : in addition, we note that the older children have on the average more carious teeth than the younger, the differences here being greater than before, though still not very significant, but these differences again gain weight from the fact that they occur for both the sex groups. Such increase in the number of carious teeth with age we might anticipate.

In addition the above tables of means and standard deviations for the two doctors, agreeing as well as they do, help to justify the original assumptions on which the method outlined above was based, and indicate that it is extremely probable that these assumptions and the consequent values of the λ's and μ's are near the truth. In this way we have obtained a method of actually redistributing the "Several" totals into the groups from which they were drawn and the manner of this redistribution in each case gives some indication of the personal equation of the two doctors. From the μ's we see that D 1's "Severals" should really be mostly in the "5" group with a smaller percentage in the "6" group : while D 5's "Severals" are to be distributed among all the groups from 1 to 6 in a fashion which can be seen at sight, from an inspection of the λ's, to be similar to the skew distributions obtained above for the different groups when we substituted for the λ's and μ's.

Now we wish to compare this method of dealing with the distributions with our first method. That method gave us, when we compared D 5 with D 1, the result that we must transfer roughly 26 per cent. from the "Rest" category to the middle category. In our later method of dealing with these distributions we have assumed "Several" to include possibly cases of one and two carious teeth, and if we find out the percentages of these cases to the whole frequency we have a figure which we can compare with that obtained by the first method.

We have the table given on the opposite page, and we find the average amount transferred is 29 per cent. ; thus we obtain practically the same figure as before, which was 26 per cent. Judged from this standpoint the two methods of dealing with the distributions give the same result.

But when we compare the means and standard deviations obtained by the two methods we see that there is a very significant difference between the means. By the second method they are in the neighbourhood of 2·1, whereas by the first method they

D 5. *Given Distribution in Three Categories and Modified Distribution in Three Categories.*

	Pf.	1·2.	Rest.	Total.	
B 13 Given	64	61	235	360	$\frac{104\cdot5}{360} = 29\cdot0$ per cent.
New	64	165·4	130·4	359·8	
Difference	—	104·4	104·6	—	
G 13 Given	61	72	204	337	$\frac{87\cdot9}{337} = 26\cdot1$ „ „
New	61	159·9	116·1	337	
Difference	—	87·9	87·9	—	
B 13½ Given	36	37	168	241	$\frac{76}{241} = 31\cdot5$ „ „
New	36	113	92·1	241·1	
Difference	—	76	75·9	—	
G 13½ Given	25	41	146	212	$\frac{64}{212} = 30\cdot2$ „ „
New	25	104·9	82·1	212	
Difference	—	63·9	63·9	—	

are smaller, nearer to 1·5. This difference is due to the fact that when working with the distributions in three categories we assumed normality for the distributions, whereas by the second method we have made no such assumption and have found the means and standard deviations from the distributions modified by the λ's and μ's. We can compare the differences obtained in this way with the differences in the means of D 4's distributions (i) when the distributions are assumed to be normal; (ii) when the actual distributions as given are used to obtain the mean.

D 4. Means of distributions.

	(i) Assuming Normality.	(ii) Distribution as given (Skew).
B 13	1·1931	1·8203
G 13	1·1859	1·9681
B 13½	1·2215	1·8859
G 13½	1·3784	2·0207

Here again we see the same difference between the means obtained in this way and we realise, in these cases of very skew distributions, how badly the Gaussian fits the actual figures.

So far then we have obtained a result which expresses the difference between D 1 and D 5, which we might term the "personal equation" in the matter of teeth distributions, and which results from an attempt to interpret "Several". D 1 classes as "Several" some cases of five carious teeth and fewer cases of six carious teeth, whereas D 5 puts in the "Several" class, some cases of one, two, three, four, five, six carious teeth. We will now deal with these results in another way.

Consider D 1. We have come to the conclusion that the tails of the distributions given by this doctor should be :—

No. of Carious Teeth.	5.	6.	7.
B 13 .	13·3	4·7	2
G 13 .	16·4	3·6	—

whereas they are given

No. of Carious Teeth.	5.	6.	7.	Sev.
B 13 .	5	4	2	9
G 13 .	9	3	—	8

That is to say 8·3 cases out of 13·3 of five carious teeth are returned as "Several,"
7·4 ,, ,, 16·4 ,, ,, ,, ,, ,,
these figures give us 62 per cent. and 45 per cent., i.e. roughly about 50 per cent. of cases of five carious teeth are returned by this doctor as "Several".

Again ·7 cases out of 4·7 of six carious teeth are returned as "Several,"
and ·6 ,, ,, 3·6 ,, ,, ,, ,, ,,
which give us 15 per cent. and 17 per cent., i.e. roughly about 16 per cent. of cases of six carious teeth are returned as "Several".

Consider D 5. The distributions given and modified are :—

B 13.									G 13.								
	Pf.	1.	2.	3.	4.	5.	6.	Sev.		Pf.	1.	2.	3.	4.	5.	6.	Sev.
New .	64	70·3	95·1	48·9	38·9	36·9	5·7	—	New .	61	66·9	93·0	42·3	37·8	31·2	4·8	—
Given .	64	36	25	7	—	1	—	227	Given .	61	38	34	7	5	1	—	191
Diff. .	—	34·3	70·1	41·9	38·9	35·9	5·7	—	Diff .	—	28·9	59·0	35·3	32·8	30·2	4·8	—
°/。 Diff./New	—	49	74	86	100	97	100	—	°/。 Diff./New	—	43	63	84	87	97	100	—

B 13½.									G 13½.								
	Pf.	1.	2.	3.	4.	5.	6.	Sev.		Pf.	1.	2.	3.	4.	5.	6.	Sev.
New .	36	46	67	33·5	28·3	26·1	4·2	—	New .	25	40	64·9	31·7	24·9	22	3·5	—
Given .	36	21	16	3	—	—	—	165	Given .	25	19	22	6	1	—	—	139
Diff. .	—	25	51	30·5	28·3	26·1	4·2	—	Diff. .	—	21	42·9	25·7	23·9	22	3·5	—
°/。 Diff./New	—	54	76	91	100	100	100	—	°/。 Diff./New	—	52	66	81	96	100	100	—

We see from this table that roughly :—

Of the cases of 1 carious tooth D 5 returns 50 per cent. as "Several".
,, ,, 2 ,, teeth ,, ,, 70 ,, ,,
,, ,, 3 ,, ,, ,, ,, 85 ,, ,,
,, ,, 4 ,, ,, ,, ,, 95 ,, ,,
,, ,, 5 ,, ,, ,, ,, all as "Several".
,, ,, 6 ,, ,, ,, ,, all ,, ,,

These figures are of course approximate and are based on the assumptions stated above that this doctor's "Several" may include all numbers of carious teeth, such an assumption being indicated as necessary when we consider the distributions by the first method, and fairly justified when we see the agreement between the means and standard deviations obtained from all the distributions given by D 1, D 5, D 3, D 4. But we would emphasise the great difference between this doctor and the other doctor D 1 (and later we shall see between this doctor and D 3 and D 4) in the returns of carious teeth, and how necessary it is to consider whether the personal equation enters into such returns, before all the data given by different doctors are grouped together, and general conclusions are drawn from such grouped data. In such a case as these teeth distributions discussed here, there is no justification for grouping all the data together, because the basic scale used by D 5 is absolutely different from that used by the other doctors and such a combination of the data would be equivalent to taking the measurements of the height of 500 school children in inches and of another 500 in centimetres, combining the two sets of data as though the scales were the same and presenting the resultant mean in inches. In this way our children would grow taller by the stroke of a pen.

(2) *D* 3 *and* *D* 4.—Similar treatment in the case of the distributions given by these two doctors, enables us to find the meaning of the word "Several" used by D 3. D 4 only uses the word in the case of G 13½ and for simplicity we shall reject that case from the distribution. We are led to conclude that D 3 means by "Several" five or more carious teeth, from a glance at the table showing the original distributions and we shall make this assumption in what follows.

Using λ_5, λ_6, λ_7, λ_8, to represent the proportions into which the "Several" category is to be redistributed into the 5, 6, 7, 8 groups, we get :—

$$\begin{aligned}\lambda_5 &= {\cdot}55700\\ \lambda_6 &= {\cdot}31681\\ \lambda_7 &= {\cdot}07516\\ \lambda_8 &= {\cdot}05101\end{aligned}$$

These λ's give us new distributions :—

D 3.	Pf.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
B 13 . . .	60	37	95	36	18	6·5	3·2	·8	·5	257
G 13 . . .	66	36	80	25	24	4·5	2·5	·6	·4	239
B 13½ . . .	49	28	84	27	19	7·8	4·4	1·1	·7	221
G 13½ . . .	58	49	64	25	25	15	8·6	2	1·4	248

and the probabilities obtained when these are compared with the D 4 distributions are :—

B 13	G 13	B 13½	G 13½
·05	·07	·02	·2

When we compare the tails of D 3's distributions before and after modification by the λ's we see that, roughly speaking, all cases of five, six, seven, and eight carious teeth are placed by this doctor in the "Several" category. This is the personal equation of this doctor when dealing with the "Several" category. But we note further difference between this doctor and D 4. The distributions given by these two doctors should be random samples from the same population, but an examination into this point reveals the fact that only in one case (G 13½) is there reasonable agreement between the two doctors. A glance at the original distributions immediately shows that the main difference between the distributions lies in the relative frequencies occurring in the one and two carious teeth groups. We can appreciate this further when we refer back to the first method of treatment of the teeth distributions, i.e. in three categories on the assumption of normality, for then we saw that there was practically no difference between the D 3 and D 4 distributions—and there we had put into one group all cases of one and two teeth carious. This is also consistent with the fact that the means and standard deviations of the distributions given by these doctors are practically the same, the means being in the region of 1·8 to 2·0, so that any differences between distributions which involve the frequencies in the 1 and 2 groups would not be reproduced in the means and standard deviations.

Further, if in the D 3 and D 4 distributions we group one and two teeth together as one group we find immediately that we get very different results in testing whether these distributions are random samples of the same population, for now we have the following probabilities :—

B 13	G 13	B 13½	G 13½
·92	·17	·90	·15.

These results are sufficiently good for us to proceed to inquire into the reason why such a grouping of one and two together should bring about such a change. One might suggest that these doctors differ in the number of cases which should be classed as having one carious tooth and those which should be classed as having two carious teeth.

When we consider that it is a question of one or two teeth being carious, there may be cases where D 3 has observed a carious tooth and after further examination has found another where caries is just starting and such cases D 3 has classed as two carious teeth. D 4 examining the same mouth may have rejected the slightly carious tooth as not to be returned and classed such a case as one carious tooth. In older children this slightly carious tooth will have become more carious and less difference will be expected between the two doctors in the return of one and two carious teeth. If we compare the B 13 distributions and the G 13½ distributions on this point we see immediately that here we have a comparison between the two extremes of our four age and sex groups, for girls approaching puberty are older than boys of the same age in physical development. We find the probability from the B 13, D 3, D 4 distributions above is ·05 and becomes ·92 when the 1 and 2 groups are combined. From the G 13½ D 3, D 4 groups we have originally ·2 becoming ·15 after the combination of the two groups. In fact the latter distributions are so closely in agreement before the change, that the change merely lowers the number of classes in the distributions and consequently lowers the probability.

Thus we suggest that the large difference between these two doctors is due to the presence of slightly carious teeth which are returned as carious by one doctor and are not returned by the other doctor. If this happens when there were three or four carious teeth, it is not emphasised in the distributions owing to the smaller numbers of such cases occurring.

(3) We note, if we assume that D 5 means by "Several" two or more, that we shall get the same kind of distribution of frequency as is given by D 3, for we should then have less numbers in the 1 group than in the Pf and 2 groups on either side of it. Suppose then that we make this assumption and attempt to fit by the same method as before the D 5 and D 1 distributions, and obtain in this way new λ's and μ's. We find :—

$$\begin{array}{ll} \lambda_2 = \cdot 32804 & \text{and } \mu_5 = 1 \\ \lambda_3 = \cdot 20351 & \mu_6 \text{ etc.} = 0 \\ \lambda_4 = \cdot 19082 & \\ \lambda_5 = \cdot 17079 & \\ \lambda_6 = \cdot 05620 & \\ \lambda_7 = \cdot 03146 & \\ \lambda_8 = \cdot 01918 & \end{array}$$

are the values which give the best results for the equations we have for the λ's and μ's and we see that now the λ's gradually decrease.,

If we use these figures and compare the D 5 and D 1 distributions now for B 13 and G 13, taking as one group 1, 2 teeth carious we have probabilities of ·85 for the B 13 distributions and ·1 for the G 13 distributions, and we have these means, taking the 1 and 2 groups as one single group at 1·5.

	D 5.	D 1.	Average of D 5 and D 1.
B 13	2·4888	2·3077	2·4373 ± ·0582
G 13	2·3951	2·0474	2·2697 ± ·0505
B 13½	2·6392	—	2·6392 ± ·0819
G 13½	2·6439	—	2·6439 ± ·0839

Similarly if we find the means of the D 3 and D 4 distributions when the 1, 2 groups are put together, the total frequency being considered as concentrated at 1·5, we get :—

	D 3.	D 4.	Average of D 5 and D 1.
B 13	1·7105	1·8153	1·7665 ± ·0401
G 13	1·6314	1·9345	1·8033 ± ·0425
B 13½	1·8267	1·8840	1·8579 ± ·0460
G 13½	2·0020	1·9835	1·9929 ± ·0497

(4) *D* 2.—We do not feel justified in comparing this doctor with any of the others, but we note that, except in the B 13 distribution, there is again the same kind of "dip" in the frequency at the "1" group as we observe in D 3's distributions, and we feel justified in assuming that we may redistribute the "Several" cases amongst the groups from 5 onwards in the same way that we have used for the other doctors —that is to say, more in group 5 than in group 6, more in 6 than in 7, etc. To do this we use the Poisson series for $m = 0{\cdot}4$ (Tables for Statisticians) and we obtain these new distributions:—

	Pf.	1.	2.	3.	4.	5.	6.	7.	8.	
B 13	15	26	49	20	19	11·4	7·3	0·3	2	150
G 13	45	27	43	28	15	11	3·4	4·5	2·1	179
B 13½	76	42	53	27	12	30·1	8·4	3·3	0·2	252
G 13½	76	50	73	36	18	16	9·2	1·6	0·1	280

the means of which, obtained by grouping the 1 and 2 frequencies together at 1·5 are:—

B 13	2·4493 ± ·0925
G 13	2·0821 ± ·0922
B 13½ . . .	1·9726 ± ·0803
G 13½ . . .	1·8282 ± ·0661

We see that the means for the urban children B 13½, G 13½ conform fairly well to those already obtained for similar types of children in the D 3, D 4 districts, and are rather different from these obtained in the D 5 area, which is comparatively much more rural than the others. The result for the B 13 distribution seems to differ greatly from the others, but we must point out that here there are 150 cases and the probable error is in consequence larger.

A comparison of these tables of means gives us the following results:—

(*a*) On the whole the mean number of carious teeth is greater in country districts than in towns and mining districts.

(*b*) The mean number of carious teeth is about two in children of 13 and 13½.

(*c*) From the D 5, D 1 and D 3, D 4 combinations we see that the older children have on the average slightly more carious teeth. In many cases these children had carious milk teeth, though the total numbers of milk teeth recorded for the later age groups is much less than those recorded for the earlier age groups, which is consistent with the fact that they would discard them with increasing age. Taking these two facts together we see that there is a definite increase in the number of permanent teeth carious as we pass from the 13 group to the 13½ group. D 2's results contradict those of the other doctors, there is some decrease in the average number of carious teeth with age, but we would rather lay more stress on results obtained from the other four doctors on account of the fact that we have been unable to compare D 2 with any of them.

(*d*) There is no real difference discernible between the sexes in the matter of carious teeth.

When we consider the meaning of the λ's in the case of D 2 we have these figures for the tails of the distributions given by this doctor :—

	Modified.				Given.				Difference.			
	5.	6.	7.	8.	5.	6.	7.	8.	5.	6.	7.	8.
B 13	11·4	7·3	0·3	2	8	6	0	2	3·4	1·3	0·3	0
G 13	11	3·4	4·5	2·1	5	1	4	2	6	2·4	0·5	0·1
B 13½	30·1	8·4	3·3	0·2	14	2	2	0	16·1	6·4	1·3	0·2
G 13½	16	9·2	1·6	0·1	8	6	1	0	8	3·2	0·6	0·1

We find that out of :—

68·5 cases of 5 carious teeth D 2 returns 33·5 as "Several," i.e. 49 per cent.
28·3 „ 6 „ „ 13·3 „ „ 47 „
9·7 „ 7 „ „ 2·7 „ „ 28 „
4·4 „ 8 „ „ 0·4 „ „ 9 „

That is to say D 2 returns roughly 50 per cent. of cases of five and six carious teeth as "Several," 30 per cent. of cases of seven carious teeth and 10 per cent. of cases of eight carious teeth.

This may be regarded as this doctor's personal equation.

When we consider again the new λ's obtained for D 5, we assumed that "Several" meant two or more. We have in the following table the modified and given tails.

	Modified.							Given.				Difference.						
	2.	3.	4.	5.	6.	7.	8.	2.	3.	4.	5.	2.	3.	4.	5.	6.	7.	8.
B 13 . .	99·5	53·2	43·3	39·8	12·8	7·1	4·3	25	7	—	1	74·5	46·2	43·3	38·8	12·8	7·1	4·3
G 13 . .	96·7	45·9	41·4	33·6	10·7	6·0	3·7	34	7	5	1	62·7	38·9	36·4	32·6	10·7	6·0	3·7
B 13½ . .	70·1	36·6	31·5	28·2	9·3	5·2	3·2	16	3	—	—	54·1	33·6	31·5	28·2	9·3	5·2	3·2
G 13½ . .	67·6	34·3	27·5	23·7	7·8	4·4	2·7	22	6	1	—	45·6	28·3	26·5	23·7	7·8	4·4	2·7

The resulting percentages of these differences on the modified frequencies are :—

	2.	3.	4.	5.	6.	7.	8.
B 13	74·9	86·8	100	97·5	100	100	100
G 13	64·8	84·7	87·9	97·0	100	100	100
B 13½	77·2	91·8	100	100	100	100	100
G 13½	67·5	82·5	96	100	100	100	100
Average	71·1	86·5	96·0	98·6	100	100	100

So that we see, roughly, that D 5 returns 70 per cent. of cases of two carious teeth as "Several," 85 per cent. of three carious teeth and all others four, five, six, seven, and eight, as "Several," and that this agrees very closely with what we obtained before when we assumed that "Several" included one or more carious teeth.

With regard to D 1 we see that as we had $\mu_5 = 1$ and μ_6, μ_7, etc., $= 0$ we get practically the same result as before, out of thirty-one cases of five carious teeth seventeen are returned as "Several," or roughly 50 per cent.

When we compare the doctors from the point of view of the meaning they attach to the word "Several" we see that D 1, D 2, and D 3 are not very different: they class as "Several" only a small proportion of the total frequencies occurring and most of these cases are cases of five or more carious teeth. D 5 on the other hand uses the word to indicate many cases of two, three, and four carious teeth, and is in this way very different from the others. If the medical inspection is primarily instituted for the purpose of finding out what is necessary for the improvement of the children's health, such classification is presumably sufficient, but if the records thus obtained are all grouped together and analysed for the purposes of an official report, then it is necessary to be sure that the same methods were used by different doctors, otherwise the results obtained must be valueless. We would emphasise this point and further remark—that if we get such differences between doctors serving in one county and under one administration, we must expect even greater differences in the different administrations in several parts of the country. If we wish to combine or compare results obtained for various parts of England, we must be sure that the same standards are used in observations by all the bodies which organise any inspection or examination, and that the individuals serving under these bodies actually are standardised so that the same report would be made by one person after examining a group of people as would be made by any other. Without such standardisation there is no justification for comparing town with town, county with county or more generally country with country, etc., as is often at present done on the basis of such examinations.

IV. NUTRITION.

(i) Turning now to the question of nutrition and the possible effect of bad teeth on nutrition we have the following distributions given by the various doctors for the different groups of children.

Nutrition is divided into four categories, good, normal, subnormal, and bad (see opposite page).

An examination of these distributions reveals the fact that most doctors have the greatest number in the normal category, and that here again the personal equation enters, for D 1 has more in the "Good" category than in the "Subnormal" category and both are small compared with those in the "Normal" category; D 5 has a much bigger proportion outside the "Normal" group with most in the "Sub-

B 13.						G 13.					
	D 1.	D 2.	D 3.	D 4.	D 5.		D 1.	D 2.	D 3.	D 4.	D 5.
Good.	5	27	11	9	27	Good.	17	55	21	31	
Normal	136	112	189	230	227	Normal	171	116	171	217	189
Subnormal	2	10	57	56	105	Subnormal	2	8	47	65	99
Bad	—	1	—	—	1	Bad	—	—	—	—	1
Total	143	150	257	295	360	Total	190	179	239	313	337
B 13½.						G 13½.					
	D 1.	D 2.	D 3.	D 4.	D 5.		D 1.	D 2.	D 3.	D 4.	D 5.
Good.	—	34	5	10	5	Good.	—	63	48	34	18
Normal	16	208	174	209	162	Normal	10	203	146	167	140
Subnormal	—	10	42	42	72	Subnormal	—	14	54	42	52
Bad	—	—	—	2	2	Bad	—	—	—	—	2
Total	16	252	221	263	241	Total	10	280	248	243	212

normal": again D 3 and D 4 have larger numbers in the outer groups with more in "Subnormal" than in "Good" while D 2 has more in "Good" than in "Subnormal". Also none of the doctors place many cases in the "Bad" group, which therefore in future will be classed with "Subnormal," and "Good" and "Normal" will be grouped together, thus making two groups called "Normal" and "Subnormal". We cannot group all our doctors together on account of the essential differences of the three types of population and we cannot group D 3 and D 4 together or D 1 and D 5 together on account of the differences in their judgment of nutrition and teeth. So we must find the correlation coefficients separately for each doctor and each group between teeth and nutrition, having two teeth groups as before and two nutrition groups as outlined above. We found the "tetrachoric" correlation coefficients and we have these results :—

TEETH AND NUTRITION.

TABLE OF CORRELATION COEFFICIENTS.

	D 1.	D 2.	D 3.	D 4.	D 5.
B 13	− ·1514 ± ·2368 *	− ·1355 ± ·1366 *	+ ·1664 ± ·0735 †	+ ·2220 ± ·0688	+ ·2870 ± ·0591
G 13	+ ·5390 ± ·1799 †	− ·1176 ± ·1391 *	+ ·1188 ± ·0781 *	− ·0793 ± ·0679 *	+ ·1376 ± ·0633 †
B 13½	—	− ·0370 ± ·1215 *	− ·0615 ± ·0854 *	+ ·1164 ± ·0830 *	+ ·2607 ± ·0746
G 13½	—	+ ·1156 ± ·1060 *	− ·0245 ± ·0756 *	+ ·1459 ± ·0801 *	+ ·1170 ± ·0883 *

+ sign indicates that good teeth and good nutrition are connected.
Mean r, each value being weighted according to its P.E., is ·1154 ± ·0198.

We note that the probable errors of these correlation coefficients are high and especially those of D 1, which is due to the fact that this doctor places such small numbers in the subnormal category. Of these correlation coefficients those marked with an asterisk are less than twice the probable error and are insignificant, those marked with a dagger are doubtful, being within the limits of twice to thrice the probable error, leaving us with possible positive correlation in three cases (B 13, D 4), (B 13, D 5), (B 13½, D 5), the largest of these being five times its probable error. We conclude then that only one doctor provides in all cases a small positive correlation between teeth and nutrition; apart from this, however, we see that there is a small but significant correlation between teeth and nutrition based on the weighted mean.

(ii) *Personal Equation.*

When we try to analyse the differences between the doctors in their distributions of the children in the nutrition groups, a glance at the table on p. 35 shows us that there is not great difference between D 3 and D 4, but that of D 5 and D 1, D 5 is pessimistic and D 1 is optimistic, since D 5 puts most of the cases outside "Normal" into "Subnormal" and D 1 does the reverse. Let us concern ourselves with D 3 and D 4. With nutrition we have no numerical scale and we cannot be certain that the doctors have put the same limits to their "Normal" groups, so we will assume that the discrepancies arise on account of different widths of the normal category being used by the doctors. If x_3 is taken as the width of this category in the scale of nutrition for D 3's distributions and x_4 similarly for D 4's distributions we have these values of the means and standard deviations, the mean being measured from the boundary between the good and normal categories and reckoned positive when on the normal side.

	B 13.		G 13.		B 13½.		G 13½.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
D 3	·30829 x_3	·40237 x_3	·38666 x_3	·45298 x_3	·30475 x_3	·34721 x_3	·47413 x_3	·60801 x_3
D 4	·31925 x_4	·36340 x_4	·38758 x_4	·47585 x_4	·35227 x_4	·36508 x_4	·46598 x_4	·49414 x_4

Now D 3 and D 4 really take samples from the same population, so we have the following system of equations:—

$$\begin{array}{ll}
\cdot 30829\, x_3 = m & \cdot 40237\, x_3 = \sigma \\
\cdot 31925\, x_4 = m & \cdot 36340\, x_4 = \sigma \\
\cdot 38666\, x_3 = m' & \cdot 45298\, x_3 = \sigma' \\
\cdot 38758\, x_4 = m' & \cdot 47585\, x_4 = \sigma' \\
\cdot 30475\, x_3 = m'' & \cdot 34721\, x_3 = \sigma'' \\
\cdot 35227\, x_4 = m'' & \cdot 36508\, x_4 = \sigma'' \\
\cdot 47413\, x_3 = m''' & \cdot 60801\, x_3 = \sigma''' \\
\cdot 46598\, x_4 = m''' & \cdot 49414\, x_4 = \sigma'''.
\end{array}$$

Where m, m', m'', m''' are the means of the populations from which D 3 and D 4 draw the samples and σ, σ', σ'', σ''' are the standard deviations.

From these we can find the best values of the ratios of the quantities x_3, x_4, m, m', m'', m''', σ, σ', σ'', σ''' to each other. We have:—

$$\begin{array}{lll}
x_3 = 3{\cdot}0087\, m'' & m = {\cdot}9458\, m'' & \sigma = 1{\cdot}1491\, m'' \\
x_4 = 3{\cdot}0238\, m'' & m' = 1{\cdot}1677\, m'' & \sigma' = 1{\cdot}3990\, m'' \\
 & m'' = m'' & \sigma'' = 1{\cdot}0728\, m'' \\
 & m''' = 1{\cdot}4176\, m'' & \sigma''' = 1{\cdot}6275\, m''.
\end{array}$$

If we take on our scale of nutrition $m'' = 1$, we have the width of the normal category given by D 3 and D 4 to be 3·0087 and 3·0238 respectively on this scale. These two values are the same within the probable error, so we see that D 3 and D 4 agree as to the limits of nutrition within which the children are "Normal". Now we will compare the means and standard deviations given by D 3 and D 4 with those of the original population which have just been obtained by the method of least squares, we have:—

	D 3.		Original.		D 4.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
B 13	·9276	1·2106	·9458	1·1491	·9653	1·0988
G 13	1·1634	1·3629	1·1677	1·3990	1·1720	1·4389
B 13½	·9169	1·0447	1·0000	1·0728	1·0652	1·1039
G 13½	1·4265	1·8293	1·4176	1·6275	1·4090	1·4942

The probable errors of the means and standard deviations of the given distributions are:—

	D 3.		D 4.	
	Mean.	S.D.	Mean.	S.D.
B 13	± ·0711	± ·0510	± ·0603	± ·0431
G 1	± ·0856	± ·0591	± ·0778	± ·0556
B 13½	± ·0685	± ·0498	± ·0684	± ·0442
G 13½	± ·1098	± ·0824	± ·0957	± ·0620

Thus the differences between the means and standard deviations in the comparative table above are never more than three times the probable error, and we may consider that the values obtained for x_3 and x_4 are reasonable, and the supposed original distributions with means and standard deviations above are probably the true distributions. We see that there is practically no difference then between D 3 and D 4 in their judgment of nutrition, for the means and standard deviations are sensibly the same and they agree in having the same width for the "Normal" category.

We turn now to the comparison between D 1 and D 5; the means and standard deviations of the distributions given by these doctors are shown in the accompanying table:—

	B 13.		G 13.		B 13½.		G 13½.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
D 5	·27298 x_5	·50505 x_5	·33294 x_5	·62371 x_5	·19829 x_5	·39328 x_5	·32458 x_5	·49200 x_5
D 1	·54803 x_1	·24938 x_1	·63187 x_1	·27391 x_1	—	—	—	—

where x_5 and x_1 are the widths of the "Normal" category as given by the two doctors. We take a supposed original population the age and sex groups of which have means and standard deviations as follows:—

$$\begin{array}{cccc} \text{B } 13 & \text{G } 13 & \text{B } 13\tfrac{1}{2} & \text{G } 13\tfrac{1}{2} \\ \mathrm{M}, \Sigma & \mathrm{M}', \Sigma' & \mathrm{M}'', \Sigma'' & \mathrm{M}''', \Sigma''' \end{array}$$

The two doctors having drawn samples of these we shall then have:—

$$\begin{array}{llll} \cdot 27298\, x_5 = \mathrm{M} & \cdot 33294\, x_5 = \mathrm{M}' & \cdot 19829\, x_5 = \mathrm{M}'' & \cdot 32458\, x_5 = \mathrm{M}''' \\ \cdot 50505\, x_5 = \Sigma & \cdot 62371\, x_5 = \Sigma' & \cdot 39328\, x_5 = \Sigma'' & \cdot 49200\, x_5 = \Sigma''' \\ \cdot 54803\, x_1 = \mathrm{M} & \cdot 63187\, x_1 = \mathrm{M}' & & \\ \cdot 24938\, x_1 = \Sigma & \cdot 27391\, x_1 = \Sigma' & & \end{array}$$

from which we obtain the best values of the ratios of the quantities M, M′, M″, M‴, Σ, Σ′, Σ″, Σ‴, x_1, x_5.

These values are given by:—

$$x_1 = \cdot 78485\, x_5$$

$$\begin{array}{ll} \mathrm{M} = \cdot 35155\, x_5 & \Sigma = \cdot 35039\, x_5 \\ \mathrm{M}' = \cdot 41443\, x_5 & \Sigma' = \cdot 41934\, x_5 \\ \mathrm{M}'' = \cdot 19829\, x_5 & \Sigma'' = \cdot 39328\, x_5 \\ \mathrm{M}''' = \cdot 32458\, x_5 & \Sigma''' = \cdot 49200\, x_5 \end{array}$$

If we take the scale of nutrition to be such that $x_5 = 3$,* then we have these values for x_1 and x_5 and for the means and standard deviations of the original population.

$$x_1 = 2\cdot 3545 \qquad x_5 = 3\cdot 0$$

B 13.		G 13.		B 13½.		G 13½.	
Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
1·0547	1·0512	1·2433	1·2580	·5949	1·1798	·9737	1·4760

---

* As is suggested in round numbers by the width of the "Normal" category for D 3 and D 4.

Let us compare these with the given means and standard deviations of D 1 and D 5, they are :—

	B 13.		G 13.		B 13½.		G 13½.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
D 5	·8189	1·5152	·9988	1·8711	·5949	1·1798	·9737	1·4760
D 1	1·2904	·5872	1·4878	·6449	—	—	—	—

We see here great differences between the means and standard deviations of the supposed original population and those of the D 5 and D 1 distributions showing that our assumption of the difference between the widths of the normal categories given by these two doctors is not sufficient to enable us to reduce their data to the same standard. But if we now assume in addition that the two doctors have different standards upon which nutrition is judged, i.e. that "mean nutrition" as judged by D 1 is different from "mean nutrition" as judged by D 5 we can allow for this by assuming that the means given by D 1 must be moved a distance μ to bring them to the means of the original population. We have then these modified equations ·54803 $x_1 - \mu = \mathrm{M}$, ·63187 $x_1 - \mu = \mathrm{M}'$, and the other ten equations being as before, we find :—

$$\begin{array}{llll} x_1 & = \cdot 81607\, x_5 & \mu & = \cdot 17848\, x_5 \\ \mathrm{M} & = \cdot 27087\, x_5 & \Sigma & = \cdot 35428\, x_5 \\ \mathrm{M}' & = \cdot 33506\, x_5 & \Sigma' & = \cdot 42362\, x_5 \\ \mathrm{M}'' & = \cdot 19829\, x_5 & \Sigma'' & = \cdot 39328\, x_5 \\ \mathrm{M}''' & = \cdot 32458\, x_5 & \Sigma''' & = \cdot 49200\, x_5 \end{array}$$

and assuming again $x_5 = 3$ we have :—

B 13.		G 13.		B 13½.		G 13½.	
Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
·8126	1·0628	1·0052	1·2709	·5949	1·1798	·9737	1·4760

$$\text{and } x_1 = 2{\cdot}4482, \qquad \mu = {\cdot}5354.$$

The means and standard deviations of the given distributions are :—

	B 13.		G. 13.		B 13½.		G 13½.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
D 5	·8189	1·5152	·9988	1·8711	·5949	1·1798	·9737	1·4760
D 1	·8063	·6105	1·0115	·6706	—	—	—	—

When we compare these with the means and standard deviations of the original distributions we see that although we have allowed for a difference in the means of the two distributions and for a difference in the width of the normal category—the standard deviations are not those of the original population. Consequently our assumptions cannot be the correct assumptions to be made in order to get rid of the differences between D 1 and D 5.

The probable errors of the means and standard deviations of the given distributions are :—

	B 13.		G 13.		B 13½.		G 13½.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
D 5	± ·0712	± ·0565	± ·0908	± ·0815	± ·0673	± ·0629	± ·0928	± ·0689
D 1	± ·1135	± ·0345	± ·1199	± ·0362	—	—	—	—

Let us make the additional assumption that, in order to reduce D 1 to the same standard as D 5, we must spread out the distribution given by D 1, i.e. let us multiply the standard deviations given by D 1 by a factor ν; then we shall have these equations :—

$$\begin{array}{llll}
{\cdot}27298\, x_5 = \mathrm{M} & {\cdot}33294\, x_5 = \mathrm{M}' & {\cdot}19829\, x_5 = \mathrm{M}'' & {\cdot}32458\, x_5 = \mathrm{M}''' \\
{\cdot}54803\, x_1 - \mu = \mathrm{M} & {\cdot}63187\, x_1 - \mu = \mathrm{M}' & {\cdot}39328\, x_5 = \Sigma'' & {\cdot}49200\, x_5 = \Sigma''' \\
{\cdot}50505\, x_5 = \Sigma & {\cdot}24938\, x_1\, \nu = \Sigma & {\cdot}62371\, x_5 = \Sigma' & {\cdot}27391\, x_1\, \nu = \Sigma'
\end{array}$$

from which to obtain x_1, x_5, μ, ν, M, M′, M″, M‴, Σ, Σ′, Σ″, Σ‴, and we have these results :—

$$\nu = 3{\cdot}0257 \qquad x_1 = {\cdot}7149\, x_5$$

$$\begin{array}{llll}
\mathrm{M} = {\cdot}2730\, x_5 & \mathrm{M}' = {\cdot}3329\, x_5 & \mathrm{M}'' = {\cdot}1983\, x_5 & \mathrm{M}''' = {\cdot}3246\, x_5 \\
\Sigma = {\cdot}5222\, x_5 & \Sigma' = {\cdot}6081\, x_5 & \Sigma'' = {\cdot}3933\, x_5 & \Sigma''' = {\cdot}4920\, x_5
\end{array}$$

$$\text{and } \mu = {\cdot}1188\, x_5.$$

Taking $x_5 = 3{\cdot}0$ again, x_1 is now 2·1446 and we have these means and standard deviations of the distributions given by D 5 and D 1 modified by μ and ν, and we can compare these with the original populations, means and standard deviations.

	B 13.		G 13.		B 13½.		G 13½.	
	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
D 5 . .	·8189	1·5152	·9988	1·8711	·5949	1·1798	·9737	1·4760
Population	·8190	1·5667	·9988	1·8243	·5949	1·1798	·9737	1·4760
D 1 . .	·8195	1·6204	·9988	1·7774	—	—	—	—

Now we see that the differences between these means and standard deviations are not great compared with the probable errors, so we conclude that compared with D 5 as standard D 1 is different in three ways :—

(*a*) The "mean nutrition" of D 1 is distant from that of D 5 by ·35 units (·1188 x_5) in the direction of better nutrition, i.e. D 1 is optimistic.

(*b*) The range of normal nutrition of D 1 is less than that of D 5,—the ratio of the two being ·7.

(*c*) In spite of (*b*) D 1 has a much greater proportion of cases in the "Normal" category, and has few cases in the extreme categories, and consequently the standard deviation is one-third of the standard deviation of D 5.

When we compare the figures obtained from D 3, D 4 with those from D 5 and D 1 we see that in the former case an assumption of 3 units as the width of the normal category gives us the following means and standard deviations for the original population.

B 13.		G 13.		B 13½.		G 13½.	
Mean.	S.D.	Mean.	S.D.	Mean.	S.D.	Mean.	S.D.
·9458	1·1491	1·1677	1·3990	1·0	1·0728	1·4176	1·6275

and in the latter case the same assumption gives us :—

·8190 1·5667 ·9988 1·8243 ·5949 1·1798 ·9737 1·4760.

We cannot attempt to compare these figures except in a rough manner since they are for two different populations; but we see that there is some difference between D 5 and D 4, the two standards, although this difference is not as great as it was in the case of the teeth distributions.

We note that in both sets of data the means and standard deviations in the case of boys are less than those for girls and on the average, girls between 12 and 14, have better nutrition than boys of the same age.

V. TEETH AND OTHER FACTORS.

(i) *Condition of Teeth and Cleanliness of Teeth.*

In the annual report for 1911 on School Medical Inspection for our county we find on page 55 that the Senior School Medical Inspector writes: "During the year D 3, D 4 and D 1 recorded various conditions of cleanliness, discoloration, etc., of teeth, in addition to the fact of caries"; and later he defines what is meant by "uncleanness" and "discoloration" in the following words :—

"*Uncleanness.*—By this term is meant a condition in which particles cling to the teeth in such a manner that they could be rubbed off with a brush or the edge of a glass spatula.

"*Discoloration.*—Perfectly sound, clean, and healthy looking teeth fall into three types—(1) the ivory white, (2) the ivory yellow, (3) the nacreous white. These appearances may be marred by discolorations of various sorts, namely, stainings or pigmentations of the teeth which either cannot be removed at all or not without strong scraping with a sharp edge. In one form of discoloration there is a general darkening or staining of the whole tooth. This is said to indicate death of the tooth pulp . . . it is not in any sense uncleanness."

"Another form of discoloration is where the surface of the teeth show coloured flecks or lines, brown or black. The flecks may coalesce into patches. . . . Sometimes there is a greenish slimy discoloration of the tooth which is said to be due to bacterial colonies. These flecks and lines, like the staining above mentioned should certainly not be taken as evidence of ordinary uncleanness, but they could no doubt be scaled off; and sedulous brushing might prevent their formation."

We therefore proceed to find the correlation between the carious condition of the teeth and the cleanliness of the teeth, for the distributions given by the doctors named above who are referred to in this paper as D 1, D 3, D 4. We note that the other two doctors also return some cases of uncleanness of teeth but these are so few that presumably D 2 and D 5 did not make the careful examination which the other three doctors before the inspection had undertaken to do. We have these results from the fourfold table method, the teeth being grouped as before for the carious condition, and into two groups clean and unclean, + sign meaning that less carious and cleaner teeth go together.

CORRELATION COEFFICIENTS.

	D 1.	D 3.	D 4.
B 13	+ ·2069 ± ·0867 †	+ ·0098 ± ·0683 *	+ ·0392 ± ·0674 *
G 13	+ ·1838 ± ·0765 †	+ ·3318 ± ·0663	+ ·1144 ± ·0671 *
B 13½	—	+ ·0655 ± ·0734 *	+ ·3455 ± ·0666
G 13½	—	+ ·3555 ± ·0643	+ ·2437 ± ·0762

Mean r, found by weighting individual r's according to the P.E.'s, is

+ ·1930 ± ·0223.

We note that four of these ten correlation coefficients, the whole of which are positive, are definitely significant, and that the mean correlation for the whole is also significant. This seems to indicate that there is a definite relation of a small amount between the fact of food particles remaining in the mouth and the carious state of the teeth. It is generally understood that before caries in a tooth can set in, a preliminary rotting of the tooth must have followed the chemical changes which take place in the remnants of food lodged in the interstices and crevices of the teeth. This seems to be borne out by the data examined above.

(ii) *Condition of Teeth and Discoloration of Teeth.*

The same three doctors' returns were examined to find the correlation between caries in the teeth and discoloration. The method adopted was like that used in the last case, the teeth being divided into two groups ; normal and discoloured, and the + sign indicates that the good teeth and non-discoloured teeth go together.

---

* $r < 2$ × P.E. † r lies between 2 and 3 × P.E.

CORRELATION COEFFICIENTS.

	D 1.	D 3.	D 4.
B 13	– ·3293 ± ·0829	– ·2785 ± ·0659	+ ·0368 ± ·0693 *
G 13	– ·0680 ± ·0779 *	– ·2353 ± ·0680	– ·0584 ± ·0672 *
B 13½	—	– ·0017 ± ·0739 *	+ ·0898 ± ·0770 *
G 13½	—	– ·1417 ± ·0667 †	+ ·2861 ± ·0780

Mean r, found by weighting individual r's according to the P.E.'s is

– ·0627 ± ·0228.

We see that four of the ten correlation coefficients are just significant, but that only one has any intensity. Also the signs of these r's are some positive, some negative, with the result that the mean r obtained, being less than three times its probable error is of doubtful value, so that we conclude that there is very little correlation between the carious state of the teeth and bad colour, and what correlation there is, seems to indicate that the better teeth are on the average those which are discoloured.

(iii) *Teeth and Nose and Throat.*

The results obtained below were arrived at by the fourfold table method, the state of " nose and throat " being divided into two classes Normal and Not-normal, the latter category including all cases of trouble in the nose or throat, or both. We note that none of the correlation coefficients are sensible and that twelve of them have positive sign and the other six have negative sign, the positive sign indicating that in the data examined the better teeth and normal nose and throat were found together.

TABLE OF CORRELATION COEFFICIENTS.

	D 1.	D 2.	D 3.	D 4.	D 5.
B 13	– ·0913 ± ·0878*	– ·1281 ± ·0920*	+ ·0047 ± ·0752*	– ·0886 ± ·0648*	+ ·0669 ± ·0683*
G 13	+ ·0760 ± ·0778*	+ ·1684 ± ·0788†	+ ·0564 ± ·0784*	+ ·0196 ± ·0630*	+ ·0094 ± ·0676*
B 13½	—	+ ·0633 ± ·0677*	– ·0263 ± ·0823*	– ·0674 ± ·0665*	+ ·0797 ± ·0805*
G 13½	—	+ ·0378 ± ·0644*	+ ·0343 ± ·0745*	– ·0914 ± ·0705*	+ ·0221 ± ·0930*

Mean r, found by weighting individual r's according to the P.E.'s, is

+ ·0088 ± ·0174, which is not significant.

(iv) *Teeth and Cleanliness of the Body and Hair.*

We do not suppose that there is any direct association between the condition of teeth and cleanliness of the body, but we can regard cleanliness as a measure

* $r < 2 \times$ P.E.

† r lies between 2 and 3 × P.E.

of the general condition of the home. The fourfold table method was used to obtain the accompanying values for the correlation coefficient, the division of "Cleanliness" being into two classes, Normal and Not-normal, the latter including all those cases which are given as having dirty hair or dirty body, or both, and the division of teeth into two classes is the same as that used throughout the paper. We may observe that eight of the correlation coefficients have positive signs and the other ten have negative signs, the positive sign indicating that the better teeth and cleaner children are found together, also we note that one coefficient only is sensible, being slightly more than three times its probable error.

TABLE OF CORRELATION COEFFICIENTS.

	D 1.	D 2.	D 3.	D 4.	D 5.
B 13	− ·1317 ± ·0888*	− ·2078 ± ·0681	− ·1146 ± ·1070*	− ·1552 ± ·0860*	− ·0054 ± ·1062*
G 13	− ·0606 ± ·0821*	− ·0213 ± ·0630*	+ ·0425 ± ·0739*	− ·1001 ± ·0600*	+ ·2104 ± ·0778†
B 13½	—	+ ·1681 ± ·0781†	+ ·0472 ± ·0702*	+ ·1915 ± ·0884†	+ ·1182 ± ·0729*
G 13½	—	− ·0970 ± ·0835*	+ ·0319 ± ·0715*	− ·0039 ± ·0699*	+ ·0754 ± ·0638*

Mean r, obtained by weighting individual r's according to the P.E.'s is

− ·0003 ± ·0179, which is not significant.

Considering cleanliness of the body and hair as some reflection on the home conditions of the child, we see that there is no sensible correlation between the carious state of the teeth and the home conditions as judged from the cleanliness of the child.

(v) *Teeth and Anæmia.*

The children were divided into two classes for anæmia, normal and anæmic, and the fourfold table method was used. Again we see that only one of the correlation coefficients is sensible, being three times its probable error and that fourteen have positive sign and four negative sign, the positive sign indicating that better teeth and normal state of the blood are found together. The mean r is found to be positive and small but significant, being five times its probable error.

TABLE OF CORRELATION COEFFICIENTS.

	D 1.	D 2.	D 3.	D 4.	D 5.
B 13	+ ·0268 ± ·1127*	+ ·1719 ± ·0910*	− ·0491 ± ·1161*	+ ·1490 ± ·0773*	+ ·1061 ± ·1227*
G 13	+ ·0238 ± ·0866*	+ ·2621 ± ·0835	+ ·2013 ± ·0858†	+ ·0173 ± ·0729*	− ·0669 ± ·0828*
B 13½	—	− ·0226 ± ·1157*	− ·0939 ± ·1434*	+ ·0877 ± ·0871*	+ ·1548 ± ·1046*
G 13½	—	+ ·1385 ± ·1110*	+ ·2518 ± ·0901†	+ ·1287 ± ·0863*	+ ·0529 ± ·0720*

* $r < 2 \times$ P.E. † r lies between 2 and 3 × P.E.

Mean r found by weighting individual r's according to the probable errors is + ·1027 ± ·0217, which is significant, but of so small an intensity as to be of little prediction value.

(vi) *Teeth and Employment of Father.*

The father's employment was graded into six classes, in order that they should represent a scale of degree of comfort in the home; the classes include the following:—

A. Farmers, shopkeepers, clerks and generally the aristocracy of labour.
B. Men of skilled trades, carpenters, etc., and the artisans of the iron works.
C. Carters, railwaymen and other transport workers; and those in service.
D. Miners and colliery workers.
E. Factory hands.
F. General labourers and farm labourers.

The division of teeth being into two classes, as before, the biserial-η method was used to find the correlation between teeth and father's employment. The sign given to the correlation ratios thus obtained was found by considering each table as a fourfold table, and the sign which would be given to the correlation coefficient, as found from such a table, was given to the correlation ratio found as above. The positive sign indicates that the better teeth are found in children whose parents are higher up the social scale. It will be seen that seven of these correlation ratios have the positive sign and eleven have the negative sign. Of these correlation ratios only two are found to be significant, on being compared with the mean of the η's which can arise when there is no real correlation between the two characters under discussion.

TABLE OF CORRELATION RATIOS (BISERIAL-η).

	D 1.	D 2.	D 3.	D 4.	D 5.
B 13	+ ·2011 ± ·0568	+ ·3199 ± ·0548	– ·2084 ± ·0423	+ ·3842 ± ·0354 *	+ ·1419 ± ·0370
G 13	– ·2411 ± ·0498	– ·3156 ± ·0531	– ·1391 ± ·0455	+ ·1405 ± ·0392	– ·1905 ± ·0377
B 13½	—	– ·2963 ± ·0417*	+ ·2060 ± ·0463	– ·1503 ± ·0441	– ·2483 ± ·0436
G 13½	—	– ·2038 ± ·0416	+ ·2545 ± ·0427	– ·2271 ± ·0428	– ·1867 ± ·0485

The two correlation ratios marked with an asterisk are significant, when compared with the mean η, obtained on the assumption that there is no correlation ("Biometrika," VIII, 254). The weighted mean of these correlation ratios is – ·0337 ± ·0103; which, if significant, is too small to be of any value. Thus from the data examined we find no appreciable correlation between the carious state of the teeth and the social status of the child as judged by the father's employment.

SUMMARY OF CONCLUSIONS AS TO TEETH.

The table below shows the mean correlation coefficients or correlation ratios obtained for the whole county in two parts, one containing those which correlate teeth and some character which might give an indication of the health of the child, the other containing those which correlate teeth and some character which might give an indication of the home conditions of the child.

Correlation of condition of teeth with :—

Weight	+ ·0381 ± ·0136
Nutrition	+ ·1154 ± ·0198
Anemia	+ ·1027 ± ·0217
Nose and throat	+ ·0088 ± ·0174
Cleanliness of body, etc.	± ·0003 ± ·0179
Father's employment	− ·0337 ± ·0103

From this table we see that there is very little correlation between teeth and the health of the child as judged by its weight, its nutrition, its being anæmic or not, and the condition of its nose and throat.

On the whole, we can find nowhere any very high degree of correlation between bad teeth and any other characters examined; in many cases the signs of the individual correlation coefficients may be either positive or negative, and the mean r, in some of the cases, becomes insensible.

We realise that the data collected by the Medical Inspectors which have been used here were not originally collected with a view to its undergoing statistical treatment, and that for the purposes of medical inspection, to return a child as having "several" teeth carious would be sufficient for the purpose of the examination, which was that the child should if necessary undergo dental treatment. But if such data could be collected with the two ends in view—first, that they should be used for drawing attention to especially bad cases and so helping to preserve the standard of health, and secondly for analysis by the statistician, very little extra trouble would be entailed and its value from the standpoint of social hygiene would rise beyond all proportion to the extra trouble involved.

VI. ASSOCIATION OF OTHER FACTORS.

We now proceed to some additional associations which can be investigated from our material.

(i) *Weight and Father's Employment.*

The tables were examined to find out if there was any relation between the health of the child (judging this by his or her weight) and the home conditions or social status as judged by the father's employment. The same grades of employment were used as before, and the following correlation ratios were obtained, the positive sign indicating that the heavier children were found in better homes, this being judged by the better type of employment. Only two of these correlation ratios are negative ; and six of them are significant after being compared with the mean η, as above. The sign was given by considering what sign a correlation coefficient would have, when found by the biserial-r method. The weighted mean η is significant, being + ·1640 ± ·0106, but again is of no great intensity ; it indicates that, on the whole, for the data examined heavier children are found in better homes.

Two diagrams given below show the means and the regression line for two of the cases where η is significant, viz., B 13, D 5 and G $13\frac{1}{2}$, D 2 (these being chosen because the total frequencies involved were large and the probable errors were small). The breadths of the categories of employment were obtained on the as-

WEIGHT OF CHILD AND EMPLOYMENT OF FATHER. B 13 D5

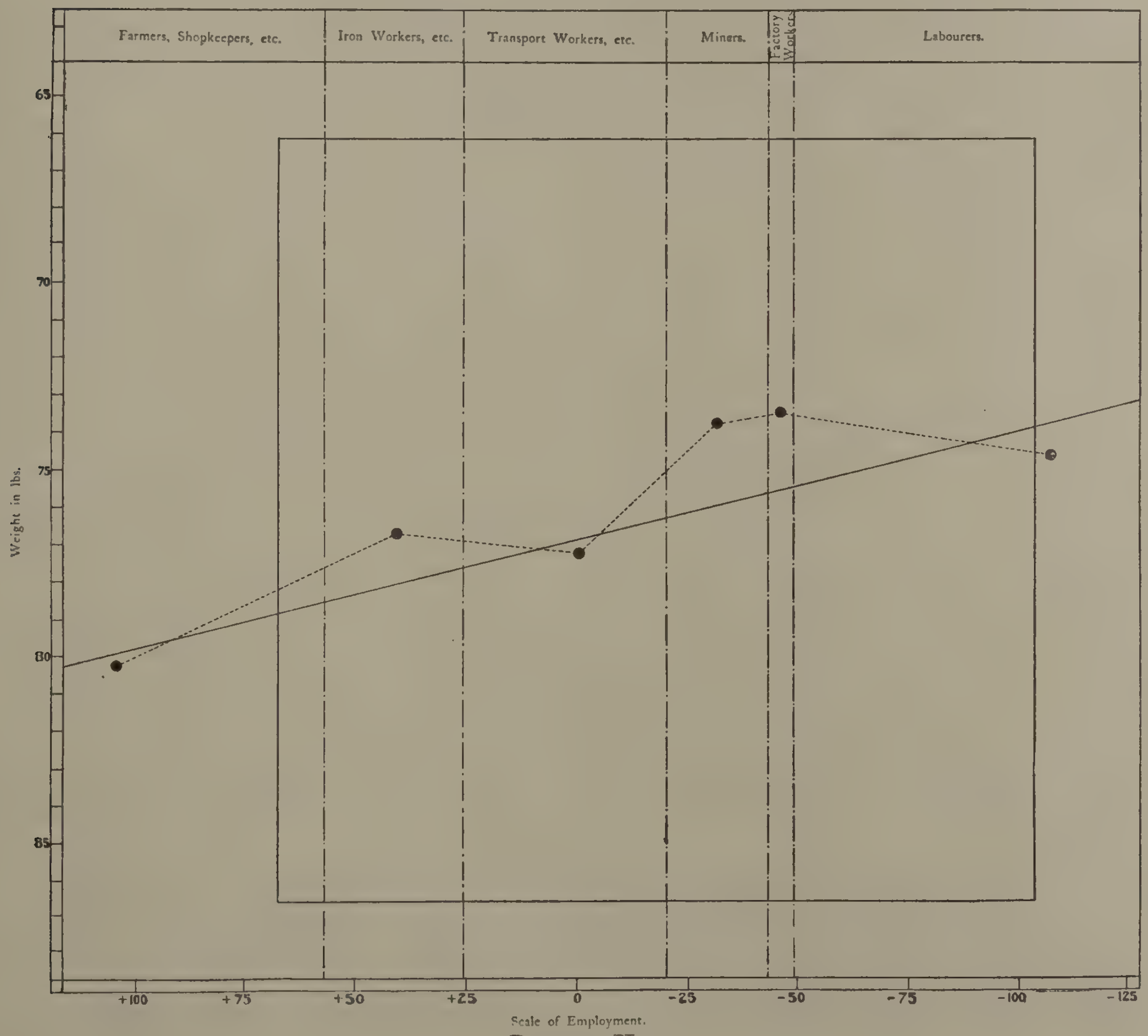

DIAGRAM II.

sumption that the distribution of employment is Gaussian, and the scale of employment shown was obtained by considering the whole population of fathers as one distribution for employment and assuming that the combined breadth of the B, C, D categories was 100 units. Also, the zero from which the employment scale is measured is the mean of the employment distribution of the whole population of fathers.

TABLE OF CORRELATION RATIO η.

	D 1.	D 2.	D 3.	D 4.	D 5.
B 13	+ ·3093 ± ·0582	+ ·5414 ± ·0562*	+ ·1650 ± ·0443	+ ·2163 ± ·0421	+ ·2423 ± ·0363*
G 13	+ ·2575 ± ·0547	+ ·2390 ± ·0801	+ ·2592 ± ·0447	+ ·1902 ± ·0410	+ ·1367 ± ·0389
B 13½	—	+ ·2689 ± ·0433	+ ·1643 ± ·0477	− ·3366 ± ·0407*	+ ·1963 ± ·0462
G 13½	—	+ ·3056 ± ·0401*	+ ·1787 ± ·0465	− ·3278 ± ·0413*	+ ·3397 ± ·0456*

WEIGHT OF CHILD AND EMPLOYMENT OF FATHER. G 13½ D2

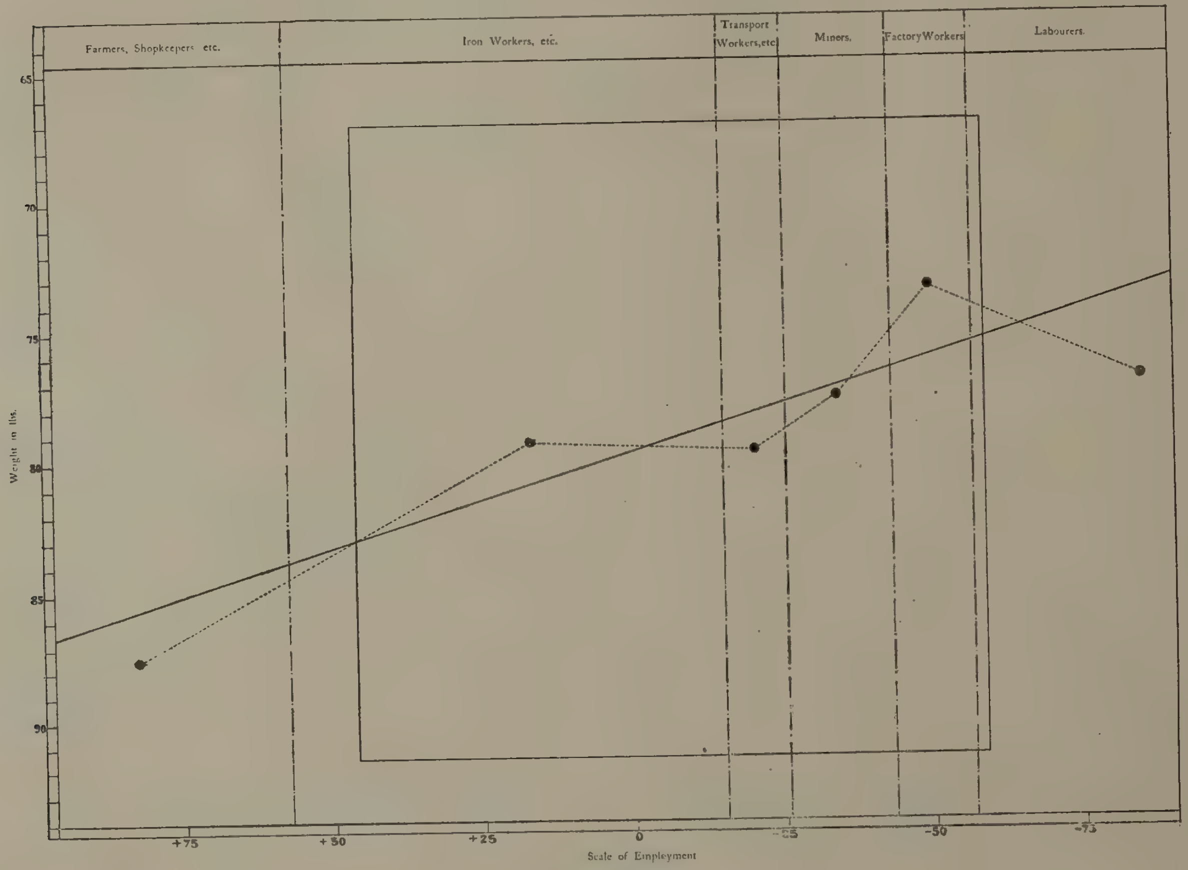

Diagram III.

We also append a diagram showing the distribution of employment of fathers (i) for the whole population; (ii) for the rural population, judging this by the children who go to the rural schools; (iii) for the urban population, judging this by the children who go to the town schools.

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* Significant η's.

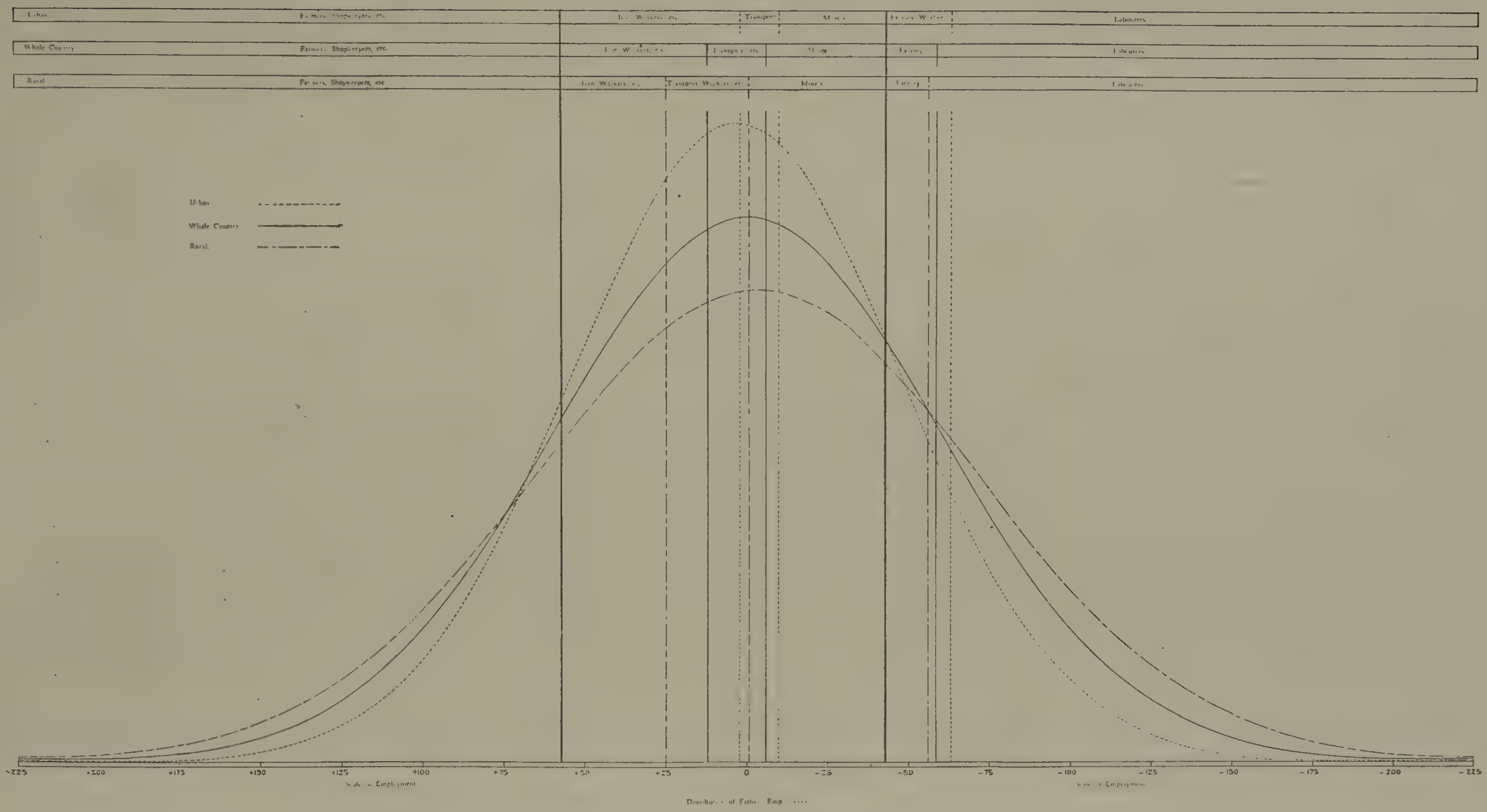
Urban
Farmers, Shopkeepers, etc.
Iron Workers, etc.
Transport
Mines
Factory Workers
Labourers
Whole Country
Farmers, Shopkeepers, etc.
Iron Workers, etc.
Transport, etc.
Mines
Factory
Labourers
Rural
Farmers, Shopkeepers, etc.
Iron Workers, etc.
Transport Workers, etc.
Mines
Factory
Labourers
Urban
Whole Country
Rural
+225
+200
+175
+150
+125
+100
+75
+50
+25
0
-25
-50
-75
-100
-125
-150
-175
-200
-225
Scale of Employment
Scale of Employment
Distribution of Father's Employment

DIAGRAM IV.

The curves are reduced so that the total area of each is the same; the width of the combined categories B, C, D is the same for each distribution. It will be seen that the standard deviations are different, but that the means are very similar; that the distribution of employment in the country is much more spread out than in the town, that is to say, the fathers in the towns who send their children to the schools examined by the School Medical Officers tend to be more of the same grade of employment than the fathers in the rural districts who send their children to the local schools. The following figures are obtained from the employment distributions and from these the diagram was drawn :—

WHOLE POPULATION (divided into 6 classes).

	A.	B.	C.	D.	E.	F.	Total.
	590	875	421	786	255	568	3495
Distance from mean to division line between classes, divided by σ		– ·95887	– ·20402	+ ·09950	+ ·72092	+ ·98413	

Assuming width of B, C, D categories combined is 100 units on the scale of employment,

we have $\frac{100}{\sigma} = 1{\cdot}67979$; $\sigma = 59{\cdot}531$ units.

COUNTRY POPULATION.

	A.	B.	C.	D.	E.	F.	Total.
	356	284	270	434	115	412	1871
Distance from mean to division line between classes, divided by σ		– ·87690	– ·40684	– ·03417	+ ·57790	+ ·77151	

Assuming width of B, C, D categories combined to be 100 units on the scale of employment,

we have $\frac{100}{\sigma} = 1{\cdot}45480$; $\sigma = 68{\cdot}738$ units.

TOWN POPULATION.

	A.	B.	C.	D.	E.	F.	Total.
	234	591	151	352	140	156	1624
Distance from mean to division line between classes, divided by σ		– 1·06214	+ ·02007	+ ·25590	+ ·90677	+ 1·30436	

Assuming width of B, C, D categories combined to be 100 units on the scale of employment,

we have $\frac{100}{\sigma} = 1{\cdot}96891$; $\sigma = 50{\cdot}790$ units.

Taking the mean of the whole population distribution as zero, we have these figures in units of employment.

Distance from zero to division line between	A, B.	B, C.	C, D.	D, E.	E, F.	Mean.	S, D.
Whole population . . .	– 57·08	– 12·15	+ 5·92	+ 42·92	+ 58·59	0	59·531
Country	– 57·08	– 24·77	+ 0·84	+ 42·92	+ 56·23	+ 3·19	68·738
Town . . , . .	– 57·08	– 2·12	+ 9·86	+ 42·92	+ 63·11	– 3·14	50·790

(ii) *Nutrition and Weight.*

If we form tables showing the distribution of weight for the two classes of nutrition, subnormal and normal, and find the correlation coefficients by the biserial method, we have the following results :—

	D 3.	D 4.	D 5.	D 2.
B 13 . .	+ ·6870 ± ·0403	+ ·6034 ± ·0465	+ ·6910 ± ·0309	+ ·6229 ± ·1351
G 13 . .	+ ·7290 ± ·0407	+ ·6111 ± ·0422	+ ·7082 ± ·0308	+ ·3122 ± ·1470*
B 13½ . .	+ ·6854 ± ·0446	+ ·5947 ± ·0478	+ ·6158 ± ·0422	+ ·1620 ± ·0962*
G 13½ . .	+ ·6439 ± ·0451	+ ·6499 ± ·0483	+ ·6532 ± ·0470	+ ·5248 ± ·0728

The positive sign indicating that the children of better nutrition are heavier.

It will be seen that D 3, D 4 and D 5 all give high correlation coefficients, but that the two marked with an asterisk of D 2's cases are not significant or are doubtful: the large probable errors are due to D 2 having such small numbers in the subnormal category.

The weighted mean of these correlation coefficients is ·6514 ± ·0114, which is of quite considerable intensity, but it might be suggested that the medical judgment as to nutrition, if not actually based on weight, was partly based on size and plumpness for a given age which would be closely related to weight.

(iii) *Nutrition and Anæmia.*

The data were examined for any possible association between nutrition and anæmia. The fourfold table method was used, but the results for D 1's groups are not shown, as the numbers of children in the subnutrition category was only two in each class B 13 and G 13½. The numbers also involved in the D 2 groups were small numbers in the subnormal category, giving large probable errors to the correlation coefficients. We have these results:—

TABLE OF CORRELATION COEFFICIENTS.

	D 2.	D 3.	D 4.	D 5.
B 13	+ ·1140 ± ·1715*	+ ·4578 ± ·1079	+ ·4267 ± ·0786	+ ·2490 ± ·0880†
G 13	+ ·0658 ± ·1437*	+ ·2650 ± ·0955†	+ ·1664 ± ·0802†	+ ·2472 ± ·0839†
B 13½	+ ·0738 ± ·1455*	+ ·3142 ± ·1523†	+ ·1732 ± ·1017*	+ ·1798 ± ·1078*
G 13½	+ ·3183 ± ·1125†	+ ·2183 ± ·1014†	+ ·3465 ± ·0929	+ ·3430 ± ·1030

The positive sign indicates that good nutrition and normal (not anæmic) children are found together. We see that although their probable errors are large, all these coefficients are positive; taken as a whole series they are all, except in the majority of D 2's groups, of the order of ·2 to ·3, and this leads us to believe that there is quite definite association between these two characters in the data examined; the mean for the whole series of correlation coefficients is + ·2659 ± ·0256. It is, however, again probable that the judgment of anæmia by *appearance* was a contributory factor in the judgment of nutrition.

VII. CONCLUSIONS.

The conclusions we can draw from this paper are of two kinds which may be classed as positive and negative.

(*a*) We see from the data examined that the degrees of association between the state of caries in the teeth of children of ages 12 to 14 years and their general health and the home environment are very slight, being roughly about 0·1 in the scale of the correlation coefficient, where the range is from 0 to 1, 0 being equivalent to absolute independence and 1 being equivalent to perfect association between two characters. We are the more impressed with the small degree of correlation between the characters under consideration, when we consider the place such correlation occupies in the scale of association, and compare the numerical value of the relationship with other numbers expressing associations between characters. For instance, the degree of relationship between parent and child has been found for many physical characters to be represented by 0·5 in our scale, which shows a much higher degree of association than that found in this paper to exist between teeth and general health and teeth and home conditions. Such considerations suggest that it would be of interest to examine if any association exists between the state of the parents' teeth and those of the children, and if such an examination gave a result of the same order as those obtained for other physical characters, i.e. about ·5, we should be justified in asserting that on the average bad teeth in a child are due more to bad teeth in the stock than to ill-attention during growth.

(*b*) The School Medical Inspections instituted by the Board of Education are primarily for the purpose of finding out the needs of our children and bringing relief where it is necessary. A statistical inquiry into the data furnished by such an inspection and the resultant comparisons to be made between the sexes, between different ages, between different districts, etc., are of secondary importance, but such inquiry is intended in the original scheme. We have seen, however, in the Blankshire data that the standards used by the doctors in diagnosing the state of nutrition, anæmia, etc., are not always the same and also that there is considerable divergence in the methods of teeth inspection, where one might expect as concise results as one obtains in measurements of height and weight. Thus the kind of treatment which has been used in this paper is necessary before the data can be properly analysed, and even with such treatment the results are not satisfactory, seeing that assumptions of one kind and another are everywhere necessary. But whereas the statistician examines his data to see if divergencies exist amongst the inspectors before attempting to compare divergencies amongst those inspected, the untrained analyser of such records will assume that there are no differences in the standards upon which the judgment of such characters as nutrition are based, and present results which often may have no meaning, because the differences between the standards used will sometimes emphasise and sometimes counteract differences which may exist in the populations from which the doctors sample. In a medical inspection of children in a large town, N., two doctors worked together; one examined all the boys, the other all the girls, and the one doctor showed results which indicated that the boys of this town were fine well-nourished children, whereas the other doctor's results showed a population of girls, the sisters of the boys examined by the other doctor, who were poor, weak, ill-nourished specimens! The two doctors had not originally compared their methods of judging nutrition by both examining separately the same sample of children.

This paper has been published with the view of emphasising the national importance of standardising the judgments of the School Medical Officers of different localities. Without this standardisation it is impossible to judge of the relative welfare of the school population in rural and in urban districts, or in urban districts with different dominant manufactures. It is not too strong a judgment—sweeping as it may seem to be—to assert that at the present day all conclusions drawn from the reports of the chief School Medical Officers are of no value for comparative purposes. This is not those officers' fault; their work is so arduous that they are bound to do much of it by deputy, and the present statistical training provided for candidates for diplomas of public health is so inadequate that many assistant School Medical Officers have not the least idea of the importance of standardisation, and even if they had, and could aim at it among their colleagues in one locality, there is at present no provision, whatever, made for a national standardisation in school inspection. The divergencies indicated in this paper would disappear with a proper local standardisation, but we should be left with what is of still greater importance from the national standpoint: the intra-district want of standardisation would disappear, but the inter-district divergencies would remain to confuse all national administrators. This problem of national standards—quite as important as those of weight and length—is one so urgent that we may well hope that the youngest of all the ministries is not yet too old to carry through some adequate measure of reform, while it has youth and freshness for this necessary but undoubtedly difficult task.

APPENDIX.—NUMERICAL TABLES.

The following tables give the data upon which the discussions in this memoir are based. It has been considered desirable to publish them as they will bring more clearly before the statistical reader the difficulties which arise in the treatment of the material.

I. NUMBER OF CARIOUS TEETH AND WEIGHT.

Boys 13.

D 1.

Weight in lb. / No. of Carious Teeth	0	1	2	3	4	5	6	7	Sev.	Total.
49⅞- 52⅞	—	—	—	—	—	—	—	—	—	—
52⅞- 55⅞	—	—	—	—	—	—	—	—	—	—
55⅞- 58⅞	—	3	—	1	—	—	—	—	—	4
58⅞- 61⅞	—	—	4	—	—	—	—	—	1	5
61⅞- 64⅞	—	1	5	3	1	—	1	—	—	11
64⅞- 67⅞	2	—	2	2	1	1	1	—	—	9
67⅞- 70⅞	1	3	4	1	3	1	—	1	1	15
70⅞- 73⅞	1	2	4	5	3	—	—	—	1	16
73⅞- 76⅞	3	5	2	1	2	—	1	—	—	14
76⅞- 79⅞	1	3	1	2	1	1	—	—	1	10
79⅞- 82⅞	3	1	—	4	3	—	—	—	1	12
82⅞- 85⅞	1	1	2	1	—	1	—	—	2	8
85⅞- 88⅞	2	2	1	1	—	—	—	—	1	7
88⅞- 91⅞	—	—	1	1	—	—	—	—	1	3
91⅞- 94⅞	—	2	—	—	—	—	—	—	—	2
94⅞- 97⅞	2	—	3	—	—	—	—	—	—	5
97⅞-100⅞	1	—	—	—	—	—	—	—	—	1
Totals .	17	23	29	22	14	4	3	1	9	122

D 2.

Weight in lb. / No. of Carious Teeth	0	1	2	3	4	5	6	7.	8	Sev.	Total.
49⅞- 52⅞	—	—	—	—	—	—	—	—	—	—	—
52⅞- 55⅞	—	—	1	—	—	—	—	—	—	—	1
55⅞- 58⅞	1	—	1	1	—	—	—	—	—	—	3
58⅞- 61⅞	1	—	1	—	—	—	1	—	—	—	3
61⅞- 64⅞	—	3	4	—	1	—	1	—	—	—	9
64⅞- 67⅞	—	3	—	—	—	1	2	—	—	1	7
67⅞- 70⅞	2	2	3	1	1	2	1	—	—	—	12
70⅞- 73⅞	—	—	4	—	2	—	1	—	—	—	7
73⅞- 76⅞	—	2	3	3	3	3	—	—	—	—	14
76⅞- 79⅞	—	4	7	2	1	—	—	—	—	—	14
79⅞- 82⅞	1	1	1	2	—	—	—	—	—	—	5
82⅞- 85⅞	2	—	2	1	—	—	—	—	1	—	6
85⅞- 88⅞	—	1	1	1	1	—	—	—	—	—	4
88⅞- 91⅞	1	1	1	—	—	—	—	—	—	—	3
91⅞- 94⅞	—	1	—	—	1	—	—	—	—	—	2
94⅞- 97⅞	—	—	—	—	—	—	—	—	—	—	—
97⅞-100⅞	—	—	—	—	—	—	—	—	—	—	—
Totals .	8	18	29	11	10	6	6	—	1	1	90

D 3.

Weight in lb. / No. of Carious Teeth	0.	1.	2.	3.	4.	5.	Sev.	Total.
40⅞- 43⅞	—	—	—	—	—	—	—	—
43⅞- 46⅞	—	—	—	—	—	—	—	—
46⅞- 49⅞	—	—	—	—	—	—	—	—
49⅞- 52⅞	—	—	—	—	—	—	—	—
52⅞- 55⅞	—	—	1	—	1	—	—	2
55⅞- 58⅞	3	1	1	—	1	—	1	7
58⅞- 61⅞	2	—	3	1	1	—	1	8
61⅞- 64⅞	—	5	4	4	—	1	2	16
64⅞- 67⅞	4	2	16	3	1	—	1	27
67⅞- 70⅞	4	3	9	4	3	—	—	23
70⅞- 63⅞	8	4	9	6	2	—	2	31
73⅞- 76⅞	6	5	14	7	1	—	1	34
76⅞- 79⅞	8	—	9	2	—	—	1	20
79⅞- 82⅞	7	3	6	3	2	—	—	21
82⅞- 85⅞	4	6	3	2	1	—	1	17
85⅞- 88⅞	1	1	3	2	1	—	—	8
88⅞- 91⅞	3	2	4	1	1	—	—	11
91⅞- 94⅞	2	1	1	—	—	—	—	4
94⅞- 97⅞	—	—	2	—	—	—	—	2
97⅞-100⅞	1	1	2	—	—	—	—	4
100⅞-103⅞	—	—	—	1	1	—	—	2
103⅞-106⅞	1	—	3	—	—	—	—	4
106⅞-109⅞	—	—	—	—	1	—	—	1
109⅞-112⅞	—	—	—	—	—	—	—	—
112⅞-115⅞	—	—	—	—	—	—	—	—
115⅞-118⅞	—	—	—	—	—	—	—	—
Totals .	54	34	90	36	17	1	10	242

D 4.

Weight in lb. / No. of Carious Teeth	0.	1.	2.	3.	4.	5.	6.	7.	8.	Total.
40⅞- 43⅞	—	—	—	—	—	—	—	—	—	—
43⅞- 46⅞	—	—	—	—	—	—	—	—	—	—
46⅞- 49⅞	—	—	—	—	—	—	—	—	—	—
49⅞- 52⅞	—	1	1	—	1	—	—	—	—	3
52⅞- 55⅞	—	—	—	—	1	—	—	—	—	1
55⅞- 58⅞	1	—	1	2	1	—	—	1	—	6
58⅞- 61⅞	1	1	8	—	1	—	—	—	—	11
61⅞- 64⅞	3	3	3	3	1	—	—	—	—	13
64⅞- 67⅞	6	10	4	5	3	4	1	—	—	33
67⅞- 70⅞	8	8	9	3	4	1	—	—	—	33
70⅞- 63⅞	6	9	14	7	2	3	—	—	1	42
73⅞- 76⅞	4	7	11	4	2	—	1	—	—	29
76⅞- 79⅞	6	6	5	4	1	1	1	—	—	24
79⅞- 82⅞	7	4	4	2	1	2	—	—	—	20
82⅞- 85⅞	3	6	4	2	2	—	—	—	—	17
85⅞- 88⅞	5	5	2	—	1	—	—	—	—	13
88⅞- 91⅞	1	2	1	2	1	—	—	—	—	7
91⅞- 94⅞	1	—	1	—	—	—	—	—	—	2
94⅞- 97⅞	—	1	—	—	—	—	—	—	—	1
97⅞-100⅞	—	—	1	1	—	—	—	—	—	2
100⅞-103⅞	—	1	1	—	1	—	—	—	—	3
103⅞-106⅞	—	—	—	—	—	—	—	—	—	—
106⅞-109⅞	—	—	—	—	—	—	—	—	—	—
109⅞-112⅞	—	—	—	—	—	—	—	—	—	—
112⅞-115⅞	—	—	—	—	—	—	—	—	—	—
115⅞-118⅞	—	—	—	—	—	—	—	—	—	—
Totals .	52	64	70	35	23	11	3	1	1	260

D 5.

Weight in lb. / No. of Carious Teeth	0.	1.	2.	3.	4.	5.	11.	Sev.	Total.
40⅞- 43⅞	—	—	—	—	—	—	—	1	1
43⅞- 46⅞	—	—	—	—	—	—	—	—	—
46⅞- 49⅞	—	—	—	—	—	—	—	—	—
49⅞- 52⅞	—	—	—	—	—	—	—	—	—
52⅞- 55⅞	—	—	—	—	—	—	—	2	2
55⅞- 58⅞	—	—	—	—	—	—	—	2	2
58⅞- 61⅞	1	—	—	—	—	—	—	8	9
61⅞- 64⅞	4	2	—	—	—	—	—	18	24
64⅞- 67⅞	8	2	4	—	—	—	—	20	34
67⅞- 70⅞	8	3	1	1	—	1	—	22	36
70⅞- 63⅞	7	3	1	1	—	—	—	36	48
73⅞- 76⅞	7	4	3	—	—	—	1	20	35
76⅞- 79⅞	6	4	3	1	—	—	—	18	32
79⅞- 82⅞	6	4	5	1	—	—	—	24	40
82⅞- 85⅞	3	5	1	—	—	—	—	17	26
85⅞- 88⅞	6	1	—	1	—	—	—	7	15
88⅞- 91⅞	3	2	4	—	—	—	—	6	15
91⅞- 94⅞	1	3	2	1	—	—	—	5	12
94⅞- 97⅞	—	—	—	—	—	—	—	3	3
97⅞-100⅞	—	—	1	—	—	—	—	3	4
100⅞-103⅞	—	1	—	—	—	—	—	2	3
103⅞-106⅞	—	—	—	—	—	—	—	1	1
106⅞-109⅞	1	—	—	—	—	—	—	—	1
109⅞-112⅞	1	—	—	—	—	—	—	—	1
112⅞-115⅞	—	—	—	—	—	—	—	—	—
115⅞-118⅞	—	1	—	—	—	—	—	—	1
Totals .	62	35	25	6	—	1	1	215	345

NUMBER OF CARIOUS TEETH AND WEIGHT.

Girls 13.

Weight in lb.	D 1.									D 2.										
No. of Carious Teeth	0.	1.	2.	3.	4.	5.	6.	Sev.	Total.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Total.
49⅞- 52⅞	—	1	—	1	—	—	—	1	3	1	—	—	—	—	—	—	—	—	—	1
52⅞- 55⅞	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
55⅞- 58⅞	1	2	1	—	1	—	—	—	5	—	—	—	1	—	—	—	—	—	—	1
58⅞- 61⅞	1	1	1	1	2	—	—	1	7	—	—	—	1	1	—	—	—	1	—	3
61⅞- 64⅞	—	3	3	1	1	—	1	1	10	2	—	3	2	—	—	—	—	—	1	8
64⅞- 67⅞	4	7	2	1	1	1	—	—	16	1	—	—	—	1	—	—	—	—	—	2
67⅞- 70⅞	1	1	6	1	2	1	—	1	13	—	1	7	4	1	1	—	—	—	—	14
70⅞- 73⅞	—	4	2	1	2	1	—	2	12	1	1	2	2	—	—	—	1	—	—	7
73⅞- 76⅞	2	2	5	1	3	—	—	—	13	2	1	2	—	3	—	—	—	—	1	9
76⅞- 79⅞	1	—	6	—	2	1	—	—	10	—	1	2	1	1	—	—	—	—	1	6
79⅞- 82⅞	3	2	2	1	—	3	—	1	12	6	—	—	2	—	1	—	—	—	1	10
82⅞- 85⅞	3	2	5	2	1	—	—	—	13	2	5	—	1	—	1	—	—	—	—	9
85⅞- 88⅞	4	1	3	—	1	—	—	—	9	1	—	—	1	—	—	—	—	—	—	2
88⅞- 91⅞	1	1	2	4	1	—	—	—	9	3	1	1	1	1	—	—	—	—	—	7
91⅞- 94⅞	1	1	2	1	—	—	—	—	5	2	—	2	2	—	—	—	—	—	—	6
94⅞- 97⅞	2	1	3	—	—	—	—	—	6	—	1	—	—	1	—	—	1	1	—	4
97⅞-100⅞	—	1	1	1	—	—	—	—	3	—	1	1	—	—	—	—	—	—	—	2
100⅞-103⅞	—	1	2	—	—	—	—	—	3	1	—	—	—	—	—	—	—	—	—	1
103⅞-106⅞	—	—	—	—	1	—	—	—	1	—	—	1	—	—	—	—	—	—	—	1
106⅞-109⅞	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
109⅞-112⅞	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1
112⅞-115⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
115⅞-118⅞	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	1
Totals .	25	32	47	16	18	7	1	7	153	22	13	21	18	9	3	—	2	2	5	95

Weight in lb.	D 3.							D 4.										D 5.							
No. of Carious Teeth	0.	1.	2.	3.	4.	Sev.	Total.	0.	1.	2.	3	4.	5.	6.	7.	8.	Total.	0.	1.	2.	3.	4.	5.	Sev.	Total.
43⅞- 46⅞	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46⅞- 49⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49⅞- 52⅞	—	1	—	—	—	—	1	1	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	1	1
52⅞- 55⅞	—	1	1	1	—	—	3	—	1	1	2	—	1	—	—	—	5	1	—	—	—	—	—	3	4
55⅞- 58⅞	2	2	4	1	1	—	10	3	2	2	1	1	—	—	—	—	9	2	—	—	—	—	—	1	3
58⅞- 61⅞	—	2	2	—	1	—	5	4	4	3	—	1	—	—	—	—	12	2	1	1	—	—	—	7	11
61⅞- 64⅞	3	1	2	1	—	1	8	3	2	4	2	4	—	2	—	—	17	6	3	2	—	—	—	15	26
64⅞- 67⅞	7	3	8	1	2	—	21	6	9	8	3	1	1	3	—	—	31	—	1	2	1	—	—	13	17
67⅞- 70⅞	4	2	8	3	3	1	21	8	2	7	3	3	2	—	—	—	25	3	2	1	1	2	—	15	24
70⅞- 73⅞	4	1	15	1	3	1	25	8	9	8	5	2	1	—	—	—	33	6	1	1	—	—	—	11	19
73⅞- 76⅞	6	6	6	—	4	1	23	5	6	4	3	1	1	—	—	—	20	6	7	3	1	—	—	23	40
76⅞- 79⅞	8	5	7	6	3	1	30	6	5	11	1	2	1	—	1	—	27	7	5	2	1	—	—	16	31
79⅞- 82⅞	8	2	4	1	1	1	17	2	4	7	3	1	1	1	—	—	19	4	4	3	1	—	—	15	27
82⅞- 85⅞	3	2	3	1	—	—	9	5	4	5	4	—	—	—	—	—	18	3	5	5	1	—	—	16	30
85⅞- 88⅞	5	1	6	2	—	—	14	—	1	5	3	1	1	1	—	—	12	7	2	4	—	—	—	5	18
88⅞- 91⅞	4	1	2	1	2	—	10	3	3	4	3	3	—	—	—	—	16	1	2	2	—	—	1	8	14
91⅞- 94⅞	1	2	1	2	1	—	7	—	2	3	2	1	1	—	—	—	9	4	—	1	—	1	—	3	9
94⅞- 97⅞	2	1	—	1	2	—	6	2	2	4	2	—	—	—	—	—	10	1	1	—	—	—	—	13	15
97⅞-100⅞	3	1	—	1	1	—	6	—	1	—	1	—	2	—	—	—	4	3	1	—	—	—	—	7	11
100⅞-103⅞	1	—	1	—	—	—	2	1	—	1	—	—	—	—	—	—	2	2	1	4	—	1	—	3	11
103⅞-106⅞	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	2	—	1	1	—	—	—	3	5
106⅞-109⅞	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	3	1	—	—	—	—	—	—	1
109⅞-112⅞	1	1	1	—	—	—	3	—	—	1	—	—	1	—	—	—	2	—	1	—	—	—	—	3	4
112⅞-115⅞	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	1	—	—	—	1
115⅞-118⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
118⅞-121⅞	—	—	1	—			1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	2
121⅞-124⅞	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—
Totals .	62	35	72	23	24	7	223	57	58	80	39	22	14	8	1	1	280	60	38	32	7	5	1	183	326

NUMBER OF CARIOUS TEETH AND WEIGHT.

BOYS 13½.

Weight in lb.	D 2.										D 3.							D 4.										D 5.					
No. of Carious Teeth	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.	0.	1.	2.	3.	4.	Sev.	Totals.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.	0.	1.	2.	3.	Sev.	Totals.
46⅞- 49⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	2	—	—	—	—	—	—
49⅞- 52⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52⅞- 55⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	1	—	—	—	—	—	—	—	1	—	—	—	—	1	1
55⅞- 58⅞	—	—	—	3	—	—	—	—	1	4	—	—	2	—	1	—	3	—	—	1	4	—	—	—	—	—	5	—	—	—	—	3	3
58⅞- 61⅞	3	1	1	1	—	2	—	—	1	9	—	—	1	—	—	—	1	2	2	2	1	4	—	1	—	—	12	1	1	—	—	4	6
61⅞- 64⅞	1	4	3	2	1	—	—	—	—	11	4	1	2	—	1	1	9	5	5	5	6	—	1	—	—	—	22	—	—	—	—	8	8
64⅞- 67⅞	4	6	4	1	—	—	—	—	1	16	1	3	4	3	—	—	11	5	7	3	7	—	—	—	—	—	22	3	1	—	—	9	13
67⅞- 70⅞	8	2	3	—	1	4	—	1	4	23	3	2	12	2	2	—	21	5	9	7	4	—	2	1	—	—	28	1	1	1	—	18	21
70⅞- 73⅞	6	4	2	2	1	1	—	—	3	19	7	4	10	4	5	1	31	9	9	11	4	1	2	—	1	1	38	3	3	1	—	19	26
73⅞- 76⅞	10	6	8	3	4	—	—	—	2	33	5	3	12	3	1	2	26	4	7	10	8	1	3	—	—	—	33	6	3	2	—	26	37
76⅞- 79⅞	9	4	9	3	1	1	1	—	1	29	7	1	9	4	2	1	24	4	5	3	1	1	—	1	—	—	15	1	2	3	1	13	20
79⅞- 82⅞	9	5	7	2	—	3	1	1	4	32	5	3	6	—	1	2	17	4	5	5	1	1	2	1	—	—	19	4	3	4	—	11	22
82⅞- 85⅞	7	4	1	2	1	1	—	—	2	18	5	2	4	—	—	1	12	7	5	4	3	2	—	—	—	—	21	4	2	—	—	9	15
85⅞- 88⅞	4	2	1	4	1	—	—	—	1	13	4	5	5	4	2	1	21	1	3	5	2	—	—	1	—	—	12	4	1	2	—	11	18
88⅞- 91⅞	4	1	2	1	1	1	—	—	—	10	3	1	4	1	2	—	11	—	—	3	1	1	—	1	—	—	6	1	—	—	1	2	4
91⅞- 94⅞	3	—	3	2	—	—	—	—	—	8	2	1	2	2	—	3	10	2	—	2	—	—	—	—	—	—	4	3	—	1	—	—	4
94⅞- 97⅞	3	—	1	—	—	—	—	—	3	7	—	1	1	1	—	1	4	1	—	1	—	—	1	—	—	—	3	—	1	1	—	5	7
97⅞-100⅞	1	1	1	—	—	—	—	—	—	3	1	—	2	1	1	1	6	—	1	—	2	—	—	—	—	—	3	—	—	1	1	4	6
100⅞-103⅞	—	1	1	—	—	1	—	—	—	3	1	—	3	—	—	—	4	2	2	—	1	—	—	—	—	—	5	1	1	—	—	3	5
103⅞-106⅞	1	—	1	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—
106⅞-109⅞	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	1	—	—	—	—	—	—	—	—	1	—	—	—	—	2	2
109⅞-112⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	1	1
112⅞-115⅞	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
115⅞-118⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
118⅞-121⅞	1	1	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—
121⅞-124⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
124⅞-127⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
Totals .	75	42	48	26	11	14	2	2	23	243	48	27	80	26	18	14	213	53	63	62	45	12	12	6	1	1	255	32	20	16	3	152	223

NUMBER OF CARIOUS TEETH AND WEIGHT.

Girls 13½.

Weight in lb. \ No. of Carious Teeth	D 2. 0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
46⅞- 49⅞	—	—	—	—	—	—	—	—	—	—
49⅞- 52⅞	—	—	—	—	—	—	—	—	—	—
52⅞- 55⅞	2	—	1	—	—	—	—	—	—	3
55⅞- 58⅞	1	1	2	—	—	—	—	—	—	4
58⅞- 61⅞	1	2	5	3	—	—	—	—	2	13
61⅞- 64⅞	3	2	2	1	1	—	—	—	—	9
64⅞- 67⅞	5	4	3	2	1	—	1	—	1	17
67⅞- 70⅞	6	6	8	—	—	1	—	1	1	23
70⅞- 73⅞	4	4	6	1	3	2	2	—	1	23
73⅞- 76⅞	4	4	4	5	2	—	—	—	1	20
76⅞- 79⅞	5	6	5	2	4	—	—	—	—	22
79⅞- 82⅞	10	4	10	7	2	2	—	—	—	35
82⅞- 85⅞	5	2	6	2	1	1	2	—	1	20
85⅞- 88⅞	3	2	2	3	—	1	—	—	—	11
88⅞- 91⅞	7	1	4	2	—	—	1	—	2	17
91⅞- 94⅞	5	3	4	3	1	1	—	—	—	17
94⅞- 97⅞	4	2	—	2	2	—	—	—	—	10
97⅞-100⅞	4	3	2	2	—	—	—	—	—	11
100⅞-103⅞	2	1	1	—	—	—	—	—	—	4
103⅞-106⅞	1	1	2	—	—	—	—	—	—	4
106⅞-109⅞	—	—	1	—	—	—	—	—	1	2
109⅞-112⅞	1	—	1	—	—	—	—	—	—	2
112⅞-115⅞	—	1	1	—	—	—	—	—	—	2
115⅞-118⅞	1	—	—	—	—	—	—	—	—	1
118⅞-121⅞	—	—	—	—	—	—	—	—	—	—
121⅞-124⅞	—	—	—	—	—	—	—	—	—	—
124⅞-127⅞	—	—	—	—	—	—	—	—	—	—
127⅞-130⅞	—	—	—	—	—	—	—	—	—	—
130⅞-133⅞	—	—	—	—	—	—	—	—	—	—
Totals .	74	49	70	35	17	8	6	1	10	270

Weight in lb. \ No. of Carious Teeth	D 3. 0.	1.	2.	3.	4.	Sev.	Totals.
46⅞- 49⅞	—	—	—	—	—	—	—
49⅞- 52⅞	—	—	—	—	—	—	—
52⅞- 55⅞	1	—	—	1	—	—	2
55⅞- 58⅞	1	1	2	—	—	1	5
58⅞- 61⅞	—	—	1	—	—	1	2
61⅞- 64⅞	2	—	—	1	1	1	5
64⅞- 67⅞	6	4	3	—	2	1	16
67⅞- 70⅞	4	5	3	2	1	2	17
70⅞- 73⅞	2	3	5	1	3	7	21
73⅞- 76⅞	11	3	6	2	5	1	28
76⅞- 79⅞	4	3	7	2	—	—	16
79⅞- 82⅞	4	5	4	5	2	1	21
82⅞- 85⅞	6	2	5	2	—	1	16
85⅞- 88⅞	2	2	2	—	3	3	12
88⅞- 91⅞	1	6	3	1	—	1	12
91⅞- 94⅞	1	2	4	1	2	1	11
94⅞- 97⅞	2	4	4	1	2	1	14
97⅞-100⅞	1	3	1	1	—	—	6
100⅞-103⅞	—	—	—	—	1	1	2
103⅞-106⅞	1	1	1	—	—	2	5
106⅞-109⅞	—	—	—	1	1	—	2
109⅞-112⅞	1	2	—	—	—	—	3
112⅞-115⅞	—	—	—	2	—	—	2
115⅞-118⅞	—	1	2	—	—	—	3
118⅞-121⅞	—	—	1	—	—	—	1
121⅞-124⅞	—	—	—	—	—	—	—
124⅞-127⅞	1	—	—	—	—	—	1
127⅞-130⅞	—	—	—	—	—	—	—
130⅞-133⅞	—	—	—	—	—	—	—
Totals .	51	47	54	23	23	25	223

Weight in lb. \ No. of Carious Teeth	D 4. 0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Sev.	Totals.
46⅞- 49⅞	—	—	—	—	—	—	—	—	—	—	—	—	—
49⅞- 52⅞	—	—	—	1	—	—	—	—	—	—	—	—	1
52⅞- 55⅞	—	—	1	—	1	1	—	—	—	—	—	—	3
55⅞- 58⅞	1	—	—	1	—	—	—	—	—	—	—	—	2
58⅞- 61⅞	1	2	2	4	2	1	—	1	—	—	—	—	13
61⅞- 64⅞	3	6	3	1	1	—	—	—	—	—	—	—	14
64⅞- 67⅞	1	1	8	1	—	—	—	—	—	—	1	—	12
67⅞- 70⅞	—	4	4	1	2	1	—	—	—	—	—	—	12
70⅞- 73⅞	10	5	2	4	—	—	1	—	—	—	—	—	22
73⅞- 76⅞	8	9	6	5	2	1	1	—	—	—	—	—	32
76⅞- 79⅞	3	2	8	4	—	1	—	—	—	—	—	—	18
79⅞- 82⅞	3	4	4	4	3	1	2	—	—	—	—	—	21
82⅞- 85⅞	4	3	5	4	—	—	—	—	—	—	—	1	17
85⅞- 88⅞	5	5	5	3	2	—	2	—	—	—	—	—	22
88⅞- 91⅞	1	1	3	1	2	1	—	—	—	—	—	—	9
91⅞- 94⅞	1	4	2	3	—	—	—	—	—	—	—	—	10
94⅞- 97⅞	—	—	2	—	1	—	—	—	—	—	—	—	3
97⅞-100⅞	1	1	1	3	—	—	—	—	—	—	—	—	6
100⅞-103⅞	—	—	3	—	1	—	—	—	—	—	—	—	4
103⅞-106⅞	—	—	1	1	1	2	—	—	—	—	—	—	5
106⅞-109⅞	—	—	1	1	—	—	—	—	—	—	—	—	2
109⅞-112⅞	—	—	1	1	—	—	—	—	—	—	—	—	2
112⅞-115⅞	—	—	1	—	—	—	—	—	—	—	—	—	1
115⅞-118⅞	—	1	—	—	—	—	—	—	—	—	—	—	1
118⅞-121⅞	—	—	—	—	—	—	—	—	—	—	—	—	—
121⅞-124⅞	—	—	—	—	—	—	—	—	—	—	—	—	—
124⅞-127⅞	—	—	—	—	—	—	—	—	—	—	—	—	—
127⅞-130⅞	—	—	—	—	—	—	—	—	—	—	—	—	—
130⅞-133⅞	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals .	42	48	63	43	18	9	6	1	—	—	1	1	232

Weight in lb. \ No. of Carious Teeth	D 5. 0.	1.	2.	3.	4.	Sev.	Totals.
46⅞- 49⅞	—	—	—	—	—	1	1
49⅞- 52⅞	—	—	—	—	—	—	—
52⅞- 55⅞	—	—	—	—	—	—	—
55⅞- 58⅞	—	1	—	—	—	1	2
58⅞- 61⅞	3	—	1	—	—	2	6
61⅞- 64⅞	2	—	—	—	—	6	8
64⅞- 67⅞	1	2	1	—	—	7	11
67⅞- 70⅞	2	1	1	1	—	7	12
70⅞- 73⅞	2	1	3	1	—	9	16
73⅞- 76⅞	2	1	3	—	—	10	16
76⅞- 79⅞	1	—	3	—	—	18	22
79⅞- 82⅞	1	2	—	1	—	8	12
82⅞- 85⅞	2	3	1	1	—	12	19
85⅞- 88⅞	1	1	2	1	—	6	11
88⅞- 91⅞	1	—	2	—	—	12	15
91⅞- 94⅞	1	2	1	—	—	9	13
94⅞- 97⅞	1	1	—	1	—	5	8
97⅞-100⅞	2	—	—	—	—	4	6
100⅞-103⅞	—	1	—	—	—	2	3
103⅞-106⅞	—	—	—	—	—	6	6
106⅞-109⅞	1	—	—	—	—	1	2
109⅞-112⅞	1	—	1	—	—	2	4
112⅞-115⅞	—	1	—	—	1	2	4
115⅞-118⅞	—	1	—	—	—	—	1
118⅞-121⅞	—	—	—	—	—	1	1
121⅞-124⅞	—	—	—	—	—	—	—
124⅞-127⅞	—	—	—	—	—	—	—
127⅞-130⅞	—	—	1	—	—	—	1
130⅞-133⅞	—	—	—	—	—	1	1
Totals .	24	18	20	6	1	132	201

II. NUMBER OF CARIOUS TEETH AND NUTRITION.

Boys 13.

Nutrition.	No. of Carious Teeth.	D 1.									
		0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
	Good .	1	—	2	—	1	—	—	1	—	5
	Normal .	23	25	31	24	14	5	4	1	9	136
	Subnormal	—	1	1	—	—	—	—	—	—	2
	Bad . .	—	—	—	—	—	—	—	—	—	—
	Totals .	24	26	34	24	15	5	4	2	9	143

Nutrition.	No. of Carious Teeth.	D 2.										
		0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
	Good .	5	4	8	5	4	1	—	—	—	—	27
	Normal .	8	20	41	15	12	6	4	—	2	4	112
	Subnormal	2	1	—	—	3	1	2	—	—	1	10
	Bad . .	—	1	—	—	—	—	—	—	—	—	1
	Totals .	15	26	49	20	19	8	6	—	2	5	150

Nutrition.	No. of Carious Teeth.	D 3.							
		0.	1.	2.	3.	4.	5.	Sev.	Totals.
	Good .	1	1	5	1	3	—	—	11
	Normal .	48	29	65	31	10	—	6	189
	Subnormal	11	7	25	4	5	1	4	57
	Bad . .	—	—	—	—	—	—	—	—
	Totals .	60	37	95	36	18	1	10	257

Nutrition.	No. of Carious Teeth.	D 4.									
		0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals
	Good .	2	3	3	—	1	—	—	—	—	9
	Normal .	53	60	61	27	17	7	3	1	1	230
	Subnormal	5	14	16	9	8	4	—	—	—	56
	Bad . .	—	—	—	—	—	—	—	—	—	—
	Totals .	60	77	80	36	26	11	3	1	1	295

Nutrition.	No. of Carious Teeth.	D 5.								
		0.	1.	2.	3.	4.	5.	11.	Sev.	Totals.
	Good .	7	4	2	2	—	—	—	12	27
	Normal .	44	27	19	4	—	—	1	132	227
	Subnormal	13	5	4	1	—	1	—	81	105
	Bad . .	—	—	—	—	—	—	—	1	1
	Totals .	64	36	25	7	—	1	1	226	360

Girls 13.

No. of Carious Teeth.	D 1.								
	0.	1.	2.	3.	4.	5.	6.	Sev.	Totals.
Good .	2	4	5	3	1	2	—	—	17
Normal .	31	36	51	14	21	7	3	8	171
Subnormal	—	—	2	—	—	—	—	—	2
Bad . .	—	—	—	—	—	—	—	—	—
Totals .	33	40	58	17	22	9	3	8	190

No. of Carious Teeth.	D 2.										
	0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
Good .	8	14	14	8	4	1	—	2	1	3	55
Normal .	34	12	27	18	11	4	1	2	1	6	116
Subnormal	3	1	2	2	—	—	—	—	—	—	8
Bad . .	—	—	—	—	—	—	—	—	—	—	—
Totals .	45	27	43	28	15	5	1	4	2	9	179

No. of Carious Teeth.	D 3.						
	0.	1.	2.	3.	4.	Sev.	Totals.
Good .	9	2	8	—	2	—	21
Normal .	49	25	54	20	19	4	171
Subnormal	8	9	18	5	3	4	47
Bad . .	—	—	—	—	—	—	—
Totals .	66	36	80	25	24	8	239

No. of Carious Teeth.	D 4.									
	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Good .	3	4	12	6	2	3	1	—	—	31
Normal .	44	50	60	24	21	11	6	1	—	217
Subnormal	18	12	15	12	5	1	1	—	1	65
Bad . .	—	—	—	—	—	—	—	—	—	—
Totals .	65	66	87	42	28	15	8	1	1	313

No. of Carious Teeth.	D 5.							
	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Good .	10	4	8	1	3	—	22	48
Normal .	34	27	18	4	1	1	104	189
Subnormal	17	7	8	2	1	—	64	99
Bad . .	—	—	—	—	—	—	1	1
Totals .	61	38	34	7	5	1	191	337

NUMBER OF CARIOUS TEETH AND NUTRITION.

Boys 13½.

Nutrition.	D 2.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Good .	11	5	9	1	1	2	—	1	4	34
Normal .	62	35	43	25	11	10	2	1	19	208
Subnormal	3	2	1	1	—	2	—	—	1	10
Bad . .	—	—	—	—	—	—	—	—	—	—
Totals .	76	42	53	27	12	14	2	2	24	252

Nutrition.	D 3.						
No. of Carious Teeth.	0.	1.	2.	3.	4.	Sev.	Totals.
Good .	1	—	2	1	—	1	5
Normal .	39	21	67	21	15	11	174
Subnormal	9	7	15	5	4	2	42
Bad . .	—	—	—	—	—	—	—
Totals .	49	28	84	27	19	14	221

Nutrition.	D 4.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Good .	5	2	2	—	—	1	—	—	—	10
Normal .	42	55	52	34	10	10	4	1	1	209
Subnormal	7	7	11	11	3	1	2	—	—	42
Bad . .	1	—	—	—	1	—	—	—	—	2
Totals .	55	64	65	45	14	12	6	1	1	263

Nutrition.	D 5.					
No. of Carious Teeth.	0.	1.	2.	3.	Sev.	Totals.
Good .	—	1	—	—	4	5
Normal .	29	16	11	2	104	162
Subnormal	7	4	5	1	55	72
Bad . .	—	—	—	—	2	2
Totals .	36	21	16	3	165	241

Girls 13½.

	D 2.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Good .	20	15	14	10	2	—	—	—	2	63
Normal .	53	33	54	25	14	8	6	1	9	203
Subnormal	3	2	5	1	2	—	—	—	1	14
Bad . .	—	—	—	—	—	—	—	—	—	—
Totals .	76	50	73	36	18	8	6	1	12	280

	D 3.						
No. of Carious Teeth.	0.	1.	2.	3.	4.	Sev.	Totals.
Good .	11	11	13	6	3	4	48
Normal .	33	28	40	16	13	16	146
Subnormal	14	10	11	3	9	7	54
Bad . .	—	—	—	—	—	—	—
Totals .	58	49	64	25	25	27	248

	D 4.												
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Sev.	Totals.
Good .	4	7	9	9	2	2	1	—	—	—	—	—	34
Normal .	35	36	45	28	13	5	5	—	—	—	—	—	167
Subnormal	6	7	14	6	4	2	—	1	—	—	1	1	42
Bad . .	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals .	45	50	68	43	19	9	6	1	—	—	1	1	243

	D 5.						
No. of Carious Teeth.	0.	1.	2.	3.	4.	Sev.	Totals.
Good .	6	1	1	—	1	9	18
Normal .	15	13	17	3	—	92	140
Subnormal	3	5	4	3	—	37	52
Bad . .	1	—	—	—	—	1	2
Totals .	25	19	22	6	1	139	212

III.—NUMBER OF CARIOUS TEETH AND CLEANLINESS OF TEETH.

Boys 13.

	D 1.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Clean .	14	8	9	11	4	1	2	—	2	51
Unclean .	10	18	25	13	11	4	2	2	7	92
Totals .	24	26	34	24	15	5	4	2	9	143

D 2.										
0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
13	23	46	16	17	5	5	2	—	4	131
2	3	3	4	2	3	1	—	—	1	19
15	26	49	20	19	8	6	2	—	5	150

	D 3.							
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Clean .	38	22	63	20	11	1	3	158
Unclean .	22	15	32	16	7	—	7	99
Totals .	60	37	95	36	18	1	10	257

D 4.									
0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
43	62	62	27	20	5	3	1	—	223
17	15	18	9	6	6	—	—	1	72
60	77	80	36	26	11	3	1	1	295

	D 5.								
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	11.	Sev.	Totals.
Clean .	63	35	25	5	—	1	1	205	335
Unclean .	1	1	—	2	—	—	—	21	25
Totals .	64	36	25	7	—	1	1	226	360

Girls 13.

	D 1.								
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	Sev.	Totals.
Clean .	18	28	31	7	13	6	1	2	106
Unclean .	15	12	27	10	9	3	2	6	84
Totals .	33	40	58	17	22	9	3	8	190

D 2.										
0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
41	26	39	24	13	4	1	3	1	9	161
4	1	4	4	2	1	—	1	1	—	18
45	27	43	28	15	5	1	4	2	9	179

	D 3.							
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Clean .	54	27	51	12	15	—	5	164
Unclean .	12	9	29	13	9	—	3	75
Totals .	66	36	80	25	24	—	8	239

D 4.									
0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
51	56	74	30	22	9	4	—	—	246
14	10	13	12	6	6	4	1	1	67
65	66	87	42	28	15	8	1	1	313

	D 5.							
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Clean .	59	37	33	7	4	1	179	320
Unclean .	2	1	1	—	1	—	12	17
Totals .	61	38	34	7	5	1	191	337

NUMBER OF CARIOUS TEETH AND CLEANLINESS OF TEETH.

Boys 13½.

No. of Carious Teeth.	D 2.									
	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Clean .	73	35	46	22	11	11	2	2	23	225
Unclean	3	7	7	5	1	3	—	—	1	27
Totals	76	42	53	27	12	14	2	2	24	252

D 3.						
0.	1.	2.	3.	4.	Sev.	Totals.
27	19	48	16	10	6	126
22	9	36	11	9	8	95
49	28	84	27	19	14	221

No. of Carious Teeth.	D 4.									
	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Clean .	50	53	45	34	10	8	3	—	1	204
Unclean	5	11	20	11	4	4	3	1	—	59
Totals	55	64	65	45	14	12	6	1	1	263

D 5.					
0.	1.	2.	3.	Sev.	Totals.
35	19	16	3	155	228
1	2	—	—	10	13
36	21	16	3	165	241

Girls 13½.

No. of Carious Teeth.	D 2.									
	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Clean .	73	46	69	33	17	7	5	1	10	261
Unclean	3	4	4	3	1	1	1	—	2	19
Totals	76	50	73	36	18	8	6	1	12	280

D 3.						
0.	1.	2.	3.	4.	Sev.	Totals.
45	41	42	15	15	13	171
13	8	22	10	10	14	77
58	49	64	25	25	27	248

No. of Carious Teeth.	D 4.										
	0.	1.	2.	3.	4.	5.	6.	7.	10.	Sev.	Totals.
Clean .	39	44	55	34	14	7	2	1	—	1	197
Unclean	6	6	13	9	5	2	4	—	1	—	46
Totals	45	50	68	43	19	9	6	1	1	1	243

D 5.						
0.	1.	2.	3.	4.	Sev.	Totals.
25	19	21	6	1	125	197
—	—	1	—	—	14	15
25	19	22	6	1	139	212

IV. NUMBER OF CARIOUS TEETH AND DISCOLORATION.

B 13, D 1.

		Condition.		
		Good.	Bad.	Totals.
Colour.	Normal	12	41	53
	Discoloured	38	52	90
	Totals	50	93	143

B 13, D 3.

Condition.		
Good.	Bad.	Totals.
109	123	232
28	35	63
137	158	295

B 13, D 4.

Condition.		
Good.	Bad.	Totals.
22	62	84
75	98	173
97	160	257

G 13, D 1.

		Condition.		
		Good.	Bad.	Totals.
Colour.	Normal	33	58	91
	Discoloured	40	59	99
	Totals	73	117	190

G 13 D 3.

Condition.		
Good.	Bad.	Totals.
28	57	85
74	80	154
102	137	239

G 13, D 4.

Condition.		
Good.	Bad.	Totals.
100	144	244
31	38	69
131	182	313

B 13½, D 3.

		Condition.		
		Good.	Bad.	Totals.
Colour.	Normal	32	60	92
	Discoloured	45	84	129
	Totals	77	144	221

B 13½, D 4.

Condition.		
Good.	Bad.	Totals.
101	117	218
18	27	45
119	144	263

G 13½, D 3.

		Condition.		
		Good.	Bad.	Totals.
Colour.	Normal	51	80	131
	Discoloured	56	61	117
	Totals	107	141	248

G 13½, D 4.

Condition.		
Good.	Bad.	Totals.
86	118	204
9	30	39
95	148	243

V. NUMBER OF CARIOUS TEETH AND STATE OF NOSE AND THROAT.

Boys 13.

Nose and Throat.	D 1.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Normal	12	13	18	11	9	4	3	2	5	77
Not Normal	12	13	16	13	6	1	1	—	4	66
Totals	24	26	34	24	15	5	4	2	9	143

Nose and Throat.	D 2.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	8.	Sev.	Totals.
Normal	7	8	23	6	9	4	4	1	2	64
Not Normal	8	18	26	14	10	4	2	1	3	86
Totals	15	26	49	20	19	8	6	2	5	150

Nose and Throat.	D 3.							
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Normal	47	29	70	34	13	—	8	201
Not Normal	13	8	25	2	5	1	2	56
Totals	60	37	95	36	18	1	10	257

Nose and Throat.	D 4.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Normal	45	48	61	22	19	10	1	1	1	208
Not Normal	15	29	19	14	7	1	2	—	—	87
Totals	60	77	80	36	26	11	3	1	1	295

Nose and Throat.	D 5.							
No. of Carious Teeth.	0.	1.	2.	3.	5.	11.	Sev.	Totals.
Normal	54	29	21	6	1	1	179	291
Not Normal	10	7	4	1	—	—	47	69
Totals	64	36	25	7	1	1	226	360

Girls 13.

Nose and Throat.	D 1.								
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	Sev.	Totals.
Normal	19	22	31	9	8	6	1	5	101
Not Normal	14	18	27	8	14	3	2	3	89
Totals	33	40	58	17	22	9	3	8	190

Nose and Throat.	D 2.										
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
Normal	21	15	20	11	4	1	—	1	—	5	78
Not Normal	24	12	23	17	11	4	1	3	2	4	101
Totals	45	27	43	28	15	5	1	4	2	9	179

Nose and Throat.	D 3.						
No. of Carious Teeth.	0.	1.	2.	3.	4.	Sev.	Totals.
Normal	53	30	71	17	16	4	191
Not Normal	13	6	9	8	8	4	48
Totals	66	36	80	25	24	8	239

Nose and Throat.	D 4.									
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Normal	43	47	62	30	17	7	5	1	1	213
Not Normal	22	19	25	12	11	8	3	—	—	100
Totals	65	66	87	42	28	15	8	1	1	313

Nose and Throat.	D 5.							
No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Normal	46	31	27	4	4	—	149	261
Not Normal	15	7	7	3	1	1	42	76
Totals	61	38	34	7	5	1	191	337

NUMBER OF CARIOUS TEETH AND STATE OF NOSE AND THROAT.

Boys 13½.

Nose and Throat.		D 2.									
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
	Normal	53	22	26	16	9	9	2	2	16	155
	Not Normal	23	20	27	11	3	5	—	—	8	97
	Totals	76	42	53	27	12	14	2	2	24	252

Girls 13½.

D 2.									
0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
47	32	44	22	10	4	5	—	8	172
29	18	29	14	8	4	1	1	4	108
76	50	73	36	18	8	6	1	12	280

Nose and Throat.		D 3.						
	No. of Carious Teeth.	0.	1.	2.	3.	4.	Sev.	Totals.
	Normal	41	19	67	23	12	12	174
	Not Normal	8	9	17	4	7	2	47
	Totals	49	28	84	27	19	14	221

D 3.						
0.	1.	2.	3.	4.	Sev.	Totals.
41	42	53	19	16	19	190
17	7	11	6	9	8	58
58	49	64	25	25	27	248

Nose and Throat.		D 4.									
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
	Normal	35	37	44	27	10	9	3	—	—	165
	Not Normal	20	27	21	18	4	3	3	1	1	98
	Totals	55	64	65	45	14	12	6	1	1	263

D 4.										
0.	1.	2.	3.	4.	5.	6.	7.	10.	Sev.	Totals.
29	30	44	28	14	8	4	1	1	—	159
16	20	24	15	5	1	2	—	—	1	84
45	50	68	43	19	9	6	1	1	1	243

Nose and Throat.		D 5.					
	No. of Carious Teeth.	0.	1.	2.	3.	Sev.	Totals.
	Normal	28	16	13	3	118	178
	Not Normal	8	5	3	—	47	63
	Totals	36	21	16	3	165	241

D 5.						
0.	1.	2.	3.	4.	Sev.	Totals.
19	13	17	3	1	99	152
6	6	5	3	—	40	60
25	19	22	6	1	139	212

VI. NUMBER OF CARIOUS TEETH AND CLEANLINESS OF BODY AND HAIR.

Boys 13.

D 1.

Hair and Body.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
	Clean .	17	12	23	19	5	3	3	2	6	90
	Unclean	7	14	11	5	10	2	1	—	3	53
	Totals	24	26	34	24	15	5	4	2	9	143

D 2.

Hair and Body.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
	Clean .	14	19	43	18	13	4	5	—	2	3	121
	Unclean	1	7	6	2	6	4	1	—	—	2	29
	Totals	15	26	49	20	19	8	6	—	2	5	150

D 3.

Hair and Body.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
	Clean .	54	36	92	33	16	1	10	242
	Unclean	6	1	3	3	2	—	—	15
	Totals	60	37	95	36	18	1	10	257

D 4.

Hair and Body.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
	Clean .	56	66	74	33	25	10	3	1	1	269
	Unclean	4	11	6	3	1	1	—	—	—	26
	Totals	60	77	80	36	26	11	3	1	1	295

D 5.

Hair and Body.	No of Carious Teeth.	0.	1.	2.	3.	5.	11.	Sev.	Totals.
	Clean .	48	28	23	6	1	1	191	298
	Unclean	16	8	2	1	—	—	35	62
	Totals	64	36	25	7	1	1	226	360

Girls 13.

D 1.

0.	1.	2.	3.	4.	5.	6.	Sev.	Totals.
8	12	15	5	6	5	1	4	56
25	28	43	12	16	4	2	4	134
33	40	58	17	22	9	3	8	190

D 2.

0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
22	16	18	10	5	2	—	2	1	4	80
23	11	25	18	10	3	1	2	1	5	99
45	27	43	28	15	5	1	4	2	9	179

D 3.

0.	1.	2.	3.	4.	Sev.	Totals.
51	25	58	19	17	5	175
15	11	22	6	7	3	64
66	36	80	25	24	8	239

D 4.

0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
33	22	40	23	13	7	4	—	1	143
32	44	47	19	15	8	4	1	—	170
65	66	87	42	28	15	8	1	1	313

D 5.

0.	1.	2.	3.	4.	5.	Sev.	Totals.
20	12	9	4	2	—	65	112
41	26	25	3	3	1	126	225
61	38	34	7	5	1	191	337

NUMBER OF CARIOUS TEETH AND CLEANLINESS OF BODY AND HAIR.

Boys 13½.

Body and Hair.	No. of Carious Teeth.	D 2.									
		0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
	Clean .	61	33	43	18	9	9	2	2	16	193
	Unclean .	15	9	10	9	3	5	—	—	8	59
	Totals .	76	42	53	27	12	14	2	2	24	252

Body and Hair.	No. of Carious Teeth.	D 3.						
		0.	1.	2.	3.	4.	Sev.	Totals.
	Clean .	46	24	76	25	16	12	199
	Unclean .	3	4	8	2	3	2	22
	Totals .	49	28	84	27	19	14	221

Body and Hair.	No. of Carious Teeth.	D 4.									
		0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
	Clean .	52	59	54	40	13	12	6	1	1	238
	Unclean .	3	5	11	5	1	—	—	—	—	25
	Totals .	55	64	65	45	14	12	6	1	1	263

Body and Hair.	No. of Carious Teeth.	D 5.					
		0.	1.	2.	3.	Sev.	Totals.
	Clean .	26	19	11	1	116	173
	Unclean .	10	2	5	2	49	68
	Totals .	36	21	16	3	165	241

Girls 13½.

D 2.									
0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
36	19	27	19	6	4	1	—	3	115
40	31	46	17	12	4	5	1	9	165
76	50	73	36	18	8	6	1	12	280

D 3.						
0.	1.	2.	3.	4.	Sev.	Totals.
44	33	46	18	15	20	176
14	16	18	7	10	7	72
58	49	64	25	25	27	248

D 4.										
0.	1.	2.	3.	4.	5.	6.	7.	10.	Sev.	Totals.
27	31	37	31	11	6	4	—	1	—	148
18	19	31	12	8	3	2	1	—	1	95
45	50	68	43	19	9	6	1	1	1	243

D 5.						
0.	1.	2.	3.	4.	Sev.	Totals.
9	5	12	1	1	50	78
16	14	10	5	—	89	134
25	19	22	6	1	139	212

VII. NUMBER OF CARIOUS TEETH AND ANÆMIA.

Boys 13. | Girls 13.

		D 1.										D 1.								
Blood.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.	0.	1.	2.	3.	4.	5.	6.	Sev.	Totals.
	Normal .	22	22	30	21	14	4	3	2	7	125	25	32	39	15	21	6	3	6	147
	Anæmic .	2	4	4	3	1	1	1	—	2	18	8	8	19	2	1	3	—	2	43
	Totals .	24	26	34	24	15	5	4	2	9	143	33	40	58	17	22	9	3	8	190

		D 2.										D 2.										
Blood.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	8.	Sev.	Totals.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
	Normal .	13	21	42	16	12	7	3	2	3	119	31	16	33	17	13	2	—	2	—	7	121
	Anæmic .	2	5	7	4	7	1	3	—	2	31	14	11	10	11	2	3	1	2	2	2	58
	Totals .	15	26	49	20	19	8	6	2	5	150	45	27	43	28	15	5	1	4	2	9	179

		D 3.								D 3.						
Blood.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.	0.	1.	2.	3.	4.	Sev.	Totals.
	Normal .	57	35	91	34	18	1	9	245	60	33	70	20	21	5	209
	Anæmic .	3	2	4	2	—	—	1	12	6	3	10	5	3	3	30
	Totals .	60	37	95	36	18	1	10	257	66	36	80	25	24	8	239

		D 4.										D 4.									
Blood.	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
	Normal .	54	69	69	29	23	8	3	1	1	257	57	54	73	35	23	13	7	1	1	264
	Anæmic .	6	8	11	7	3	3	—	—	—	38	8	12	14	7	5	2	1	—	—	49
	Totals .	60	77	80	36	26	11	3	1	1	295	65	66	87	42	28	15	8	1	1	313

		D 5.								D 5.							
Blood.	No. of Carious Teeth.	0.	1.	2.	3.	5.	11.	Sev.	Totals.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
	Normal .	62	34	22	7	1	1	210	337	61	34	31	7	4	1	171	309
	Anæmic .	2	2	3	—	—	—	16	23	—	4	3	—	1	—	20	28
	Totals .	64	36	25	7	1	1	226	360	61	38	34	7	5	1	191	337

NUMBER OF CARIOUS TEETH AND ANÆMIA.

Boys 13½.

		D 2.									
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Blood.	Normal .	69	34	41	21	9	14	1	1	22	212
	Anæmic .	7	8	12	6	3	—	1	1	2	40
	Totals .	76	42	53	27	12	14	2	2	24	252

		D 3.						
	No. of Carious Teeth.	0.	1.	2.	3.	4.	Sev.	Totals.
Blood.	Normal .	47	27	83	27	18	12	214
	Anæmic .	2	1	1	—	1	2	7
	Totals .	49	28	84	27	19	14	221

		D 4.									
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Blood.	Normal .	51	57	58	38	11	12	6	1	1	235
	Anæmic .	4	7	7	7	3	—	—	—	—	28
	Totals .	55	64	65	45	14	12	6	1	1	263

		D 5.					
	No. of Carious Teeth.	0.	1.	2.	3.	Sev.	Totals.
Blood.	Normal .	35	18	14	3	155	225
	Anæmic .	1	3	2	—	10	16
	Totals .	36	21	16	3	165	241

Girls 13½.

D 2.									
0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
60	42	55	31	12	8	5	—	10	223
16	8	18	5	6	—	1	1	2	57
76	50	73	36	18	8	6	1	12	280

D 3.						
0.	1.	2.	3.	4.	Sev.	Totals.
55	46	59	18	23	24	225
3	3	5	7	2	3	23
58	49	64	25	25	27	248

D 4.										
0.	1.	2.	3.	4.	5.	6.	7.	10.	Sev.	Totals.
41	44	60	35	17	6	6	1	—	1	211
4	6	8	8	2	3	—	—	1	—	32
45	50	68	43	19	9	6	1	1	1	243

D 5.						
0.	1.	2.	3.	4.	Sev.	Totals.
23	18	21	4	1	124	191
2	1	1	2	—	15	21
25	19	22	6	1	139	212

VIII. NUMBER OF CARIOUS TEETH AND EMPLOYMENT OF FATHER.

Boys 13.

		D 1.									
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Grade of Employment.	A	7	3	5	5	4	2	1	1	—	28
	B	5	4	3	2	1	1	—	—	2	18
	C	3	2	4	3	2	—	2	—	—	16
	D	4	5	3	2	2	—	—	—	3	19
	E	—	3	5	4	—	—	—	—	—	12
	F	5	5	12	5	5	1	—	1	3	37
Totals		24	22	32	21	14	4	3	2	8	130

		D 2.									
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	8.	Sev.	Totals.
Grade of Employment.	A	2	6	5	2	1	1	1	—	1	19
	B	1	4	8	5	7	—	—	—	1	26
	C	4	5	9	3	6	1	1	1	—	30
	D	1	2	3	—	1	1	—	1	1	10
	E	2	2	3	—	—	—	1	—	—	8
	F	3	2	13	4	1	3	2	—	1	29
Totals		13	21	41	14	16	6	5	2	4	122

		D 3.							
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Grade of Employment.	A	12	8	21	16	5	—	3	65
	B	3	7	16	3	3	—	1	33
	C	7	4	8	2	—	1	1	23
	D	15	8	22	5	4	—	2	56
	E	3	3	11	6	1	—	—	24
	F	10	4	11	3	3	—	1	32
Totals		50	34	89	35	16	1	8	233

		D 4.									
	No. of Carious Teeth.	0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Grade of Employment.	A	4	9	8	7	3	1	—	—	—	32
	B	13	15	9	4	5	2	—	—	—	48
	C	4	6	11	—	1	2	1	—	—	25
	D	19	30	34	16	15	5	—	1	1	121
	E	5	3	5	5	—	—	—	—	—	18
	F	6	7	3	2	—	—	2	—	—	20
Totals		51	70	70	34	24	10	3	1	1	264

		D 5.							
	No. of Carious Teeth.	0.	1.	2.	3.	5.	11.	Sev.	Totals.
Grade of Employment.	A	10	8	7	2	—	—	34	61
	B	6	2	5	1	—	—	21	35
	C	10	9	4	2	—	—	41	66
	D	4	4	1	1	—	1	26	37
	E	—	1	—	1	—	—	6	8
	F	26	8	4	—	1	—	74	113
Totals		56	32	21	7	1	1	202	320

Grades of Employment.—A = Clerks, Farmers, Shopkeepers, etc.
B = Skilled Trades and Iron Workers.
C = Transport Workers and those employed in Service.
D = Miners and Colliery Workers.
E = Factory Hands.
F = General and Farm Labourers.

NUMBER OF CARIOUS TEETH AND EMPLOYMENT OF FATHER.

GIRLS 13.

No. of Carious Teeth.	D 1.								
	0.	1.	2.	3.	4.	5.	6.	Sev.	Totals.
Grade of Employment. A	9	6	10	5	4	—	1	2	37
B	4	3	12	1	4	2	—	1	27
C	3	6	4	1	4	2	—	—	20
D	6	11	6	2	3	3	—	1	32
E	—	1	1	—	—	—	—	—	2
F	9	8	14	6	3	1	2	2	45
Totals	31	35	47	15	18	8	3	6	163

D 2.										
0.	1.	2.	3.	4.	5.	6.	7.	8.	Sev.	Totals.
5	5	5	4	3	—	—	—	—	1	23
4	5	7	3	2	—	—	1	—	—	22
6	6	10	6	3	2	—	—	—	—	33
3	1	5	5	—	1	1	1	—	1	18
1	1	—	1	—	—	—	—	—	—	3
15	3	5	4	2	—	—	1	1	1	32
34	21	32	23	10	3	1	3	1	3	131

No. of Carious Teeth.	D 3.						
	0.	1.	2.	3.	4.	Sev.	Totals.
Grade of Employment. A	14	7	21	8	5	1	56
B	9	5	9	4	7	1	35
C	7	3	6	2	2	1	21
D	13	10	18	4	2	—	47
E	6	4	8	2	1	1	22
F	8	3	9	2	6	2	30
Totals	57	32	71	22	23	6	211

D 4.									
0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
12	8	10	1	2	2	1	—	—	36
9	7	10	7	5	2	1	—	—	41
5	7	7	5	2	2	—	—	—	28
30	25	42	21	9	6	4	—	—	137
1	7	2	4	3	2	—	1	—	20
4	5	7	3	2	—	1	—	—	22
61	59	78	41	23	14	7	1	—	284

No. of Carious Teeth.	D 5.							
	0.	1.	2.	3.	4.	5.	Sev.	Totals.
Grade of Employment. A	10	11	7	3	1	1	22	55
B	4	6	6	2	—	—	31	49
C	11	6	8	1	1	—	33	60
D	4	2	4	1	—	—	15	26
E	2	—	—	—	—	—	4	6
F	23	10	3	—	2	—	63	101
Totals	54	35	28	7	4	1	168	297

NUMBER OF CARIOUS TEETH AND EMPLOYMENT OF FATHER.

Boys 13½.

D 2.

No. of Carious Teeth.		0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Grade of Employment.	A	13	9	6	1	1	3	—	—	1	34
	B	18	14	22	12	4	6	—	—	12	88
	C	9	6	7	3	1	1	—	—	1	28
	D	11	2	5	—	—	1	1	—	2	22
	E	8	—	4	2	1	—	—	—	—	15
	F	7	6	3	6	2	2	1	1	3	31
Totals		66	37	47	24	9	13	2	1	19	218

D 3.

0.	1.	2.	3.	4.	Sev.	Totals.
6	3	10	3	1	2	25
15	5	12	5	8	3	48
1	1	7	1	—	—	10
16	15	33	14	5	5	88
3	2	3	—	—	—	8
3	2	6	1	2	2	16
44	28	71	24	16	12	195

D 4.

No. of Carious Teeth.		0.	1.	2.	3.	4.	5.	6.	7.	8.	Totals.
Grade of Employment.	A	7	6	4	6	—	2	1	—	—	26
	B	22	24	29	19	3	4	2	—	1	104
	C	3	2	6	3	3	—	—	—	—	17
	D	15	13	9	6	6	2	—	1	—	52
	E	1	5	1	3	1	—	—	—	—	11
	F	3	2	3	3	1	1	—	—	—	13
Totals		51	52	52	40	14	9	3	1	1	223

D 5.

0.	1.	2.	3.	Sev.	Totals.
9	4	4	1	31	49
9	6	2	1	31	49
4	1	3	—	32	40
2	2	—	—	9	13
6	4	2	1	23	36
4	2	3	—	15	24
34	19	14	3	141	211

Girls 13½.

D 2.

No. of Carious Teeth.		0.	1.	2.	3.	4.	5.	6.	7.	Sev.	Totals.
Grade of Employment.	A	6	5	8	3	2	—	—	—	2	26
	B	28	24	29	13	8	3	1	—	7	113
	C	2	2	5	4	2	1	—	—	2	18
	D	9	3	5	7	2	—	—	1	—	27
	E	3	3	4	3	1	—	2	—	1	17
	F	16	4	11	5	2	2	1	—	—	41
Totals		64	41	62	35	17	6	4	1	12	242

D 3.

0.	1.	2.	3.	4.	Sev.	Totals.
4	2	7	1	4	5	23
13	16	7	9	6	3	54
2	2	4	1	—	2	11
25	19	30	10	10	14	108
1	3	4	1	—	—	9
7	1	2	—	2	1	13
52	43	54	22	22	25	218

D 4.

No. of Carious Teeth.		0.	1.	2.	3.	4.	5.	6.	7.	10.	Sev.	Totals.
Grade of Employment.	A	3	4	8	5	2	—	—	—	—	—	22
	B	18	30	31	14	8	6	5	1	1	—	114
	C	2	—	6	1	—	1	—	—	—	1	11
	D	13	7	14	13	7	2	—	—	—	—	56
	E	2	3	1	4	—	—	—	—	—	—	10
	F	2	4	2	2	—	—	—	—	—	—	10
Totals		40	48	62	39	17	9	5	1	1	1	223

D 5.

0.	1.	2.	3.	4.	Sev.	Totals.
4	3	6	—	—	23	36
6	6	5	4	1	31	53
1	3	1	—	—	20	25
3	—	1	—	—	8	12
2	5	6	1	—	24	38
4	2	1	—	—	9	16
20	19	20	5	1	115	180

IX. WEIGHT OF CHILD AND EMPLOYMENT OF FATHER.

Boys 13.

D 1.

	Weight in lb.															Totals.
Grade of Employment.	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	
A	—	—	1	1	3	3	3	3	2	1	2	—	1	1	1	22
B	—	2	—	1	3	1	1	—	1	3	3	2	—	—	—	17
C	—	—	1	2	2	1	2	—	4	—	1	1	—	1	—	15
D	1	2	1	1	3	1	1	3	1	—	—	—	—	1	—	15
E	1	—	2	—	1	2	1	1	2	1	—	—	—	1	—	12
F	1	1	6	2	2	5	5	3	1	1	1	—	—	1	—	29
Totals .	3	5	11	7	14	13	13	10	11	6	7	3	1	5	1	110

D 2.

	Weight in lb.														Totals.
Grade of Employment.	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	
A	—	—	—	—	1	1	2	—	4	1	—	2	—	—	11
B	—	—	—	—	—	2	2	3	3	3	2	—	1	—	16
C	—	1	—	3	1	3	—	4	2	—	2	1	1	1	19
D	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
E	1	1	—	1	2	1	—	—	1	—	—	—	—	—	7
F	—	—	2	3	—	5	1	3	2	1	1	—	—	—	18
Totals .	1	2	2	7	4	12	5	10	12	5	5	3	2	2	72

D 3.

	Weight in lb.																		Totals.
Grade of Employment.	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	
A	—	2	2	2	5	5	8	13	5	4	3	3	5	1	—	2	—	1	—	61
B	1	—	1	—	4	4	2	6	3	2	4	1	2	—	1	—	1	—	—	32
C	—	—	—	2	2	4	2	1	1	2	1	1	2	1	—	—	1	1	—	21
D	—	3	1	7	5	3	8	5	3	3	4	2	—	1	1	1	1	—	1	49
E	—	—	—	2	4	4	3	3	1	2	2	1	1	1	—	—	—	—	—	24
F	1	2	1	3	3	2	4	4	5	4	2	—	—	—	—	—	—	1	—	32
Totals .	2	7	5	16	23	22	27	32	18	17	16	8	10	4	2	3	3	3	1	219

WEIGHT OF CHILD AND EMPLOYMENT OF FATHER.

Boys 13.

D 4.

Grade of Employment.	Weight in lb.																		Totals.
	49⅞–52⅞	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	
A	—	—	—	—	1	1	4	6	1	7	3	—	—	2	1	1	1	—	28
B	—	1	—	2	—	5	2	7	7	—	3	5	2	1	—	—	—	1	36
C	—	—	—	—	1	2	2	3	1	4	1	1	1	—	—	—	—	1	17
D	—	—	5	7	10	15	16	17	13	8	5	9	7	4	—	—	1	1	118
E	1	—	—	—	—	4	1	4	1	1	3	—	—	—	—	—	—	—	15
F	—	—	—	—	—	3	3	3	3	2	3	—	1	—	1	—	—	—	19
Totals .	1	1	5	9	12	30	28	40	26	22	18	15	11	7	2	1	2	3	233

D 5.

Grade of Employment.	Weight in lb.																									Totals.
	43⅞–46⅞	46⅞–49⅞	49⅞–52⅞	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	
A	—	—	—	—	—	—	3	5	5	4	4	4	12	6	3	5	3	1	1	1	—	1	—	—	—	58
B	—	—	—	1	—	—	2	3	5	3	3	5	5	2	3	1	1	—	—	1	—	—	—	—	—	35
C	1	—	—	—	—	4	1	5	5	11	6	10	4	4	2	2	4	—	3	—	—	—	—	—	1	63
D	—	—	—	—	1	1	1	3	3	8	4	5	2	4	—	—	—	—	—	—	—	—	—	—	—	32
E	—	—	—	—	—	1	1	1	—	1	2	—	1	—	—	—	1	—	—	—	—	—	—	—	—	8
F	—	—	—	1	1	3	12	12	14	16	13	5	12	5	5	5	2	1	—	1	—	—	1	—	—	109
Totals .	1	—	—	2	2	9	20	29	32	43	32	29	36	21	13	13	11	2	4	3	—	1	1	—	1	305

Girls 13.

D 1.

Grade of Employment.	Weight in lb.																							Totals.
	49⅞–52⅞	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	
A	2	—	—	1	2	3	1	2	3	1	3	3	2	3	—	—	1	1	—	—	—	—	—	28
B	—	—	1	—	2	—	3	2	1	—	2	3	2	2	1	2	—	—	—	—	—	—	—	21
C	—	—	1	2	1	2	—	1	2	1	1	1	2	—	1	2	—	1	—	—	—	—	1	19
D	—	—	1	1	1	4	3	3	—	1	2	4	—	1	1	1	—	1	—	—	—	—	—	24
E	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
F	—	1	—	2	3	5	5	1	4	5	4	1	2	—	1	—	1	—	—	1	—	—	—	36
Totals .	2	1	4	7	9	14	12	9	10	8	12	12	8	6	4	5	2	3	—	1	—	—	1	130

WEIGHT OF CHILD AND EMPLOYMENT OF FATHER.

Girls 13.

D 2.

	Weight in lb.																			
Grade of Employment.	$55\frac{7}{8}$–$58\frac{7}{8}$	$58\frac{7}{8}$–$61\frac{7}{8}$	$61\frac{7}{8}$–$64\frac{7}{8}$	$64\frac{7}{8}$–$67\frac{7}{8}$	$67\frac{7}{8}$–$70\frac{7}{8}$	$70\frac{7}{8}$–$73\frac{7}{8}$	$73\frac{7}{8}$–$76\frac{7}{8}$	$76\frac{7}{8}$–$79\frac{7}{8}$	$79\frac{7}{8}$–$82\frac{7}{8}$	$82\frac{7}{8}$–$85\frac{7}{8}$	$85\frac{7}{8}$–$88\frac{7}{8}$	$88\frac{7}{8}$–$91\frac{7}{8}$	$91\frac{7}{8}$–$94\frac{7}{8}$	$94\frac{7}{8}$–$97\frac{7}{8}$	$97\frac{7}{8}$–$100\frac{7}{8}$	$100\frac{7}{8}$–$103\frac{7}{8}$	$103\frac{7}{8}$–$106\frac{7}{8}$	$106\frac{7}{8}$–$109\frac{7}{8}$	$109\frac{7}{8}$–$112\frac{7}{8}$	Totals.
A	—	—	—	—	2	2	1	—	2	2	—	—	2	—	—	—	—	—	—	11
B	—	—	1	—	4	1	—	—	2	2	—	1	—	2	—	1	—	—	—	14
C	1	—	2	—	1	—	2	2	1	3	1	1	2	—	—	—	—	—	1	17
D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
E	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
F	—	2	2	—	2	3	3	—	2	1	1	1	1	1	1	—	—	—	—	20
Totals .	1	2	6	—	9	6	6	2	7	8	2	3	5	3	1	1	—	—	1	63

D 3.

	Weight in lb.																							
Grade of Employment.	$49\frac{7}{8}$–$52\frac{7}{8}$	$52\frac{7}{8}$–$55\frac{7}{8}$	$55\frac{7}{8}$–$58\frac{7}{8}$	$58\frac{7}{8}$–$61\frac{7}{8}$	$61\frac{7}{8}$–$64\frac{7}{8}$	$64\frac{7}{8}$–$67\frac{7}{8}$	$67\frac{7}{8}$–$70\frac{7}{8}$	$70\frac{7}{8}$–$73\frac{7}{8}$	$73\frac{7}{8}$–$76\frac{7}{8}$	$76\frac{7}{8}$–$79\frac{7}{8}$	$79\frac{7}{8}$–$82\frac{7}{8}$	$82\frac{7}{8}$–$85\frac{7}{8}$	$85\frac{7}{8}$–$88\frac{7}{8}$	$88\frac{7}{8}$–$91\frac{7}{8}$	$91\frac{7}{8}$–$94\frac{7}{8}$	$94\frac{7}{8}$–$97\frac{7}{8}$	$97\frac{7}{8}$–$100\frac{7}{8}$	$100\frac{7}{8}$–$103\frac{7}{8}$	$103\frac{7}{8}$–$106\frac{7}{8}$	$106\frac{7}{8}$–$109\frac{7}{8}$	$109\frac{7}{8}$–$112\frac{7}{8}$	$112\frac{7}{8}$–$115\frac{7}{8}$	$115\frac{7}{8}$–$118\frac{7}{8}$	$118\frac{7}{8}$–$121\frac{7}{8}$	Totals.
A	—	—	2	1	1	6	6	5	5	4	5	4	4	—	4	1	2	—	—	—	—	—	—	1	51
B	1	1	2	2	2	2	2	4	4	4	1	1	1	2	1	1	1	1	—	—	—	—	—	—	33
C	—	—	—	—	1	—	2	3	1	4	2	1	4	1	—	1	—	—	—	—	1	—	—	—	21
D	—	—	3	1	1	5	6	7	6	4	6	1	2	2	—	—	—	—	—	—	—	—	—	—	44
E	—	—	—	—	2	2	1	2	1	3	1	1	2	2	—	1	1	—	—	—	2	—	—	—	21
F	—	1	2	1	1	3	3	2	3	4	—	—	—	3	2	1	1	1	—	—	—	—	—	—	28
Totals .	1	2	9	5	8	18	20	23	20	23	15	8	13	10	7	5	5	2	—	—	3	—	—	1	198

D 4.

	Weight in lb.																								
Grade of Employment.	$49\frac{7}{8}$–$52\frac{7}{8}$	$52\frac{7}{8}$–$55\frac{7}{8}$	$55\frac{7}{8}$–$58\frac{7}{8}$	$58\frac{7}{8}$–$61\frac{7}{8}$	$61\frac{7}{8}$–$64\frac{7}{8}$	$64\frac{7}{8}$–$67\frac{7}{8}$	$67\frac{7}{8}$–$70\frac{7}{8}$	$70\frac{7}{8}$–$73\frac{7}{8}$	$73\frac{7}{8}$–$76\frac{7}{8}$	$76\frac{7}{8}$–$79\frac{7}{8}$	$79\frac{7}{8}$–$82\frac{7}{8}$	$82\frac{7}{8}$–$85\frac{7}{8}$	$85\frac{7}{8}$–$88\frac{7}{8}$	$88\frac{7}{8}$–$91\frac{7}{8}$	$91\frac{7}{8}$–$94\frac{7}{8}$	$94\frac{7}{8}$–$97\frac{7}{8}$	$97\frac{7}{8}$–$100\frac{7}{8}$	$100\frac{7}{8}$–$103\frac{7}{8}$	$103\frac{7}{8}$–$106\frac{7}{8}$	$106\frac{7}{8}$–$109\frac{7}{8}$	$109\frac{7}{8}$–$112\frac{7}{8}$	$112\frac{7}{8}$–$115\frac{7}{8}$	$115\frac{7}{8}$–$118\frac{7}{8}$	$118\frac{7}{8}$–$121\frac{7}{8}$	$121\frac{7}{8}$–$124\frac{7}{8}$	Totals.
A	—	—	—	2	2	3	1	5	3	4	2	2	3	2	1	1	—	1	—	1	—	—	—	—	—	33
B	—	2	—	2	1	2	6	4	1	1	5	2	1	2	1	1	—	—	—	—	—	—	—	—	—	31
C	—	—	1	1	1	1	3	5	1	2	1	2	—	—	2	—	—	—	—	2	—	—	—	—	—	22
D	1	3	5	6	10	17	13	13	9	11	6	5	6	6	3	4	2	—	2	—	2	1	—	—	—	125
E	—	—	2	—	1	—	—	—	3	3	1	3	1	1	1	2	—	—	—	—	—	—	—	—	1	19
F	—	—	—	—	—	5	—	3	1	4	1	3	1	2	—	1	—	1	—	—	—	—	—	—	—	22
Totals .	1	5	8	11	15	28	23	30	18	25	16	17	12	13	8	9	2	2	2	3	2	1	—	—	1	252

WEIGHT OF CHILD AND EMPLOYMENT OF FATHER.

Girls 13.

D 5.

Grade of Employment.	Weight in lb.																							Totals.
	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	118⅞–121⅞	
A	—	—	3	4	3	3	3	6	3	3	8	5	1	—	4	1	—	1	—	3	—	2	—	53
B	2	1	—	5	3	1	3	5	1	5	9	3	1	1	4	3	1	1	—	—	—	—	—	49
C	1	1	3	3	4	5	3	10	6	4	1	3	1	4	1	2	2	1	—	—	1	—	—	56
D	—	—	—	3	1	5	1	2	—	7	3	—	1	1	—	—	2	—	—	—	—	—	—	26
E	—	—	—	—	—	—	1	—	1	—	—	—	2	1	—	1	—	—	—	—	—	—	—	6
F	1	1	4	11	6	6	6	10	15	6	5	5	6	2	4	3	4	1	—	1	—	—	2	99
Totals. .	4	3	10	26	17	20	17	33	26	25	26	16	12	9	13	10	9	4	—	4	1	2	2	289

Boys 13½.

D 2.

Grade of Employment.	Weight in lb.																						Totals.
	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	118⅞–121⅞	
A	—	—	1	—	4	1	5	6	2	6	—	2	—	2	2	—	1	—	—	1	—	—	33
B	—	5	7	7	8	8	11	10	13	2	3	3	3	3	1	1	—	—	—	—	—	—	85
C	1	1	—	—	2	2	3	2	7	1	3	1	1	1	—	2	—	—	—	—	—	—	27
D	—	2	1	1	3	3	2	3	2	1	2	—	—	—	—	—	—	—	—	—	—	—	20
E	1	—	—	2	—	3	1	5	—	—	1	1	—	—	—	—	—	—	—	—	—	1	15
F	1	—	1	3	3	—	5	1	8	1	1	2	2	1	—	—	—	—	—	—	—	—	29
Totals .	3	8	10	13	20	17	27	27	32	11	10	9	6	7	3	3	1	—	—	1	—	1	209

Boys 13½.

D 3.

Grade of Employment.	Weight in lb.																			Totals.
	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	
A	—	—	—	1	2	2	2	4	1	2	1	4	—	3	1	1	1	—	—	25
B	1	—	—	3	2	5	9	3	4	4	2	6	2	3	1	2	—	—	—	47
C	—	—	—	—	—	—	3	3	1	1	—	1	—	—	—	—	—	—	—	9
D	—	2	1	3	6	8	10	8	11	8	6	8	5	3	1	2	2	—	1	85
E	—	—	—	—	—	1	1	2	—	—	2	1	1	—	—	—	—	—	—	8
F	—	—	—	1	1	2	2	4	2	1	—	1	1	—	—	—	—	—	—	15
Totals .	1	2	1	8	11	18	27	24	19	16	11	21	9	9	3	5	3	—	1	189

WEIGHT OF CHILD AND EMPLOYMENT OF FATHER.

Boys 13½.

D 4.

Grade of Employment.	Weight in lb.																									Totals.
	46⅞–49⅞	49⅞–52⅞	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	118⅞–121⅞	
A	—	—	—	—	—	1	2	2	4	4	1	1	3	2	—	1	—	—	2	—	—	1	—	—	—	24
B	1	—	—	2	5	11	8	14	22	14	9	5	5	3	1	—	—	2	1	1	—	—	—	—	—	104
C	—	—	—	1	3	2	1	—	1	1	1	2	2	1	—	1	—	—	1	—	—	—	—	—	—	17
D	—	—	—	—	1	2	4	6	4	5	2	7	6	3	2	1	1	1	1	—	1	—	—	—	1	48
E	—	—	1	1	2	1	1	—	1	2	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	11
F	1	—	—	—	—	1	2	1	2	1	1	—	3	—	—	—	—	—	—	—	—	—	—	—	—	12
Totals .	2	—	1	4	11	18	18	23	34	27	14	15	20	9	4	3	1	3	5	1	1	1	—	—	1	216

D 5.

Grade of Employment.	Weight in lb.																									Totals.
	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	118⅞–121⅞	121⅞–124⅞	124⅞–127⅞	
A	—	—	1	2	4	4	3	3	7	6	2	4	1	1	1	2	2	—	2	1	—	—	—	—	—	46
B	1	—	—	2	1	5	4	10	4	4	2	4	1	—	4	—	2	—	—	—	—	1	—	—	—	45
C	—	1	2	1	2	1	8	3	4	4	1	5	1	1	—	1	—	—	—	—	1	—	—	—	1	37
D	—	—	—	1	2	1	3	2	—	2	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	13
E	—	—	2	2	2	6	2	10	1	1	4	1	1	—	—	1	—	—	—	—	—	—	—	—	—	33
F	—	1	1	—	1	2	3	3	3	2	2	1	—	2	1	1	—	—	—	—	—	—	—	—	—	23
Totals .	1	2	6	8	12	19	23	31	19	19	11	15	4	4	7	6	4	—	2	1	1	1	—	—	1	197

Girls 13½.

D 2.

Grade of Employment.	Weight in lb.																						Totals.
	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	
A	—	—	—	1	—	1	4	3	—	2	3	1	—	1	4	2	—	—	2	—	1	1	26
B	—	1	5	4	8	11	9	8	12	10	8	5	9	6	3	5	—	1	—	—	1	—	106
C	—	—	2	1	2	—	1	2	—	4	—	1	1	1	1	1	1	—	—	—	—	—	18
D	1	1	1	1	2	2	3	3	1	4	2	—	1	3	—	1	1	—	—	—	—	—	27
E	—	—	2	—	3	2	2	1	3	2	1	1	—	—	—	—	—	—	—	—	—	—	17
F	2	1	—	2	2	5	3	1	5	7	5	—	3	2	1	—	—	—	—	—	—	—	39
Totals .	3	3	10	9	17	21	22	18	21	29	19	8	14	13	9	9	2	1	2	—	2	1	233

WEIGHT OF CHILD AND EMPLOYMENT OF FATHER.

Girls 13½.

D 3.

		Weight in lb.																								
		52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	118⅞–121⅞	121⅞–124⅞	124⅞–127⅞	Totals.
Grade of Employment.	A	—	—	—	—	1	2	3	3	3	2	3	1	2	1	—	—	1	—	—	—	—	—	—	—	—	22
	B	—	1	—	—	1	5	7	8	4	6	1	2	1	2	7	3	—	1	—	—	1	—	—	—	—	50
	C	—	—	—	—	—	2	—	—	—	1	1	1	2	1	—	1	—	—	—	—	—	—	—	—	1	10
	D	1	3	2	2	9	7	5	11	6	8	8	6	5	2	5	2	1	3	2	3	1	2	1	—	—	95
	E	—	—	—	—	2	—	2	1	1	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	8
	F	—	—	—	1	3	—	1	2	1	1	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	12
Totals .		1	4	2	3	16	16	18	25	15	18	13	10	10	10	12	6	2	5	2	3	2	2	1	—	1	197

D 4.

		Weight in lb.																						
		49⅞–52⅞	52⅞–55⅞	55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	Totals.
Grade of Employment.	A	—	—	—	—	1	2	—	—	3	4	4	2	2	1	—	—	2	1	—	—	—	—	—	22
	B	1	2	1	9	9	6	7	12	18	6	10	4	9	6	1	2	2	1	—	—	—	—	1	107
	C	—	—	—	1	—	—	2	—	—	1	1	2	—	—	—	—	—	—	1	—	1	1	—	10
	D	—	—	1	1	2	1	3	6	5	4	4	5	5	1	7	1	1	2	4	—	—	—	—	53
	E	—	—	—	—	2	—	—	—	—	1	1	1	2	—	1	—	1	—	—	1	—	—	—	10
	F	—	—	—	1	—	—	—	2	3	—	—	1	1	1	1	—	—	—	—	—	—	—	—	10
Totals .		1	2	2	12	14	9	12	20	29	16	20	15	19	9	10	3	6	4	5	1	1	1	1	212

D 5.

		Weight in lb.																										
		55⅞–58⅞	58⅞–61⅞	61⅞–64⅞	64⅞–67⅞	67⅞–70⅞	70⅞–73⅞	73⅞–76⅞	76⅞–79⅞	79⅞–82⅞	82⅞–85⅞	85⅞–88⅞	88⅞–91⅞	91⅞–94⅞	94⅞–97⅞	97⅞–100⅞	100⅞–103⅞	103⅞–106⅞	106⅞–109⅞	109⅞–112⅞	112⅞–115⅞	115⅞–118⅞	118⅞–121⅞	121⅞–124⅞	124⅞–127⅞	127⅞–130⅞	130⅞–133⅞	Totals.
Grade of Employment.	A	—	—	1	2	3	4	4	3	1	2	4	1	3	3	—	—	1	1	—	1	1	—	—	—	—	1	36
	B	1	2	1	3	1	4	5	5	2	3	2	3	3	2	4	1	1	—	2	1	—	—	—	—	1	—	47
	C	—	—	2	1	1	3	—	2	1	3	1	1	3	2	—	—	2	—	—	—	—	1	—	—	—	—	23
	D	—	—	2	2	—	1	1	2	2	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	11
	E	—	2	—	3	4	2	3	6	1	5	1	5	3	—	—	1	1	—	1	—	—	—	—	—	—	—	38
	F	—	1	1	—	1	1	1	1	2	3	—	2	1	—	1	—	—	—	—	1	—	—	—	—	—	—	16
Totals .		1	5	7	11	10	15	14	19	9	16	8	12	13	7	5	2	5	1	4	3	1	1	—	—	1	1	171

X. NUTRITION AND WEIGHT.

Boys 13.

Weight in lb.	D 2.					D 3.				D 4.				D 5.				
Nutrition	Good.	Normal.	Sub-normal.	Bad.	Totals.	Good.	Normal.	Sub. normal.	Totals.	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Bad.	Totals.
40⅞– 43⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
43⅞– 46⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46⅞– 49⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49⅞– 52⅞	—	—	—	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—
52⅞– 55⅞	—	1	—	—	1	—	—	2	2	—	1	—	1	—	—	2	—	2
55⅞– 58⅞	—	2	1	—	3	—	3	4	7	—	1	5	6	—	—	1	1	2
58⅞– 61⅞	—	2	1	—	3	—	2	6	8	—	8	3	11	—	2	7	—	9
61⅞– 64⅞	—	9	—	—	9	—	7	9	16	—	6	7	13	—	8	16	—	24
64⅞– 67⅞	—	5	1	1	7	—	10	17	27	—	21	12	33	—	13	21	—	34
67⅞– 70⅞	3	8	1	—	12	—	15	8	23	—	27	6	33	—	23	13	—	36
70⅞– 73⅞	1	6	—	—	7	—	29	2	31	1	37	4	42	—	31	17	—	48
73⅞– 76⅞	3	11	—	—	14	—	33	1	34	—	27	2	29	—	28	7	—	35
76⅞– 79⅞	4	9	1	—	14	—	17	3	20	—	22	2	24	1	21	10	—	32
79⅞– 82⅞	1	4	—	—	5	1	19	1	21	—	20	—	20	4	34	2	—	40
82⅞– 85⅞	2	4	—	—	6	—	17	—	17	2	14	1	17	4	20	2	—	26
85⅞– 88⅞	1	3	—	—	4	—	8	—	8	2	11	—	13	5	10	—	—	15
88⅞– 91⅞	2	1	—	—	3	1	10	—	11	1	6	—	7	2	13	—	—	15
91⅞– 94⅞	1	1	—	—	2	—	4	—	4	—	2	—	2	2	10	—	—	12
94⅞– 97⅞	—	—	—	—	—	1	1	—	2	—	1	—	1	2	1	—	—	3
97⅞–100⅞	—	—	—	—	—	2	2	—	4	—	2	—	2	2	2	—	—	4
100⅞–103⅞	—	—	—	—	—	1	1	—	2	3	—	—	3	2	1	—	—	3
103⅞–106⅞	—	—	—	—	—	3	1	—	4	—	—	—	—	—	1	—	—	1
106⅞–109⅞	—	—	—	—	—	1	—	—	1	—	—	—	—	1	—	—	—	1
109⅞–112⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
112⅞–115⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
115⅞–118⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1
Totals .	18	66	5	1	90	10	179	53	242	9	206	45	260	26	219	99	1	345

NUTRITION AND WEIGHT.

Girls 13.

Weight in lb.	D 2.				D 3.				D 4.				D 5.				
Nutrition	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Bad.	Totals.
43⅞– 46⅞	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—
46⅞– 49⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49⅞– 52⅞	—	1	—	1	—	—	1	1	—	—	2	2	—	—	1	—	1
52⅞– 55⅞	—	—	—	—	—	—	3	3	—	1	4	5	—	—	4	—	4
55⅞– 58⅞	—	1	—	1	—	4	6	10	—	4	5	9	—	1	2	—	3
58⅞– 61⅞	—	3	—	3	—	1	4	5	—	5	7	12	—	1	10	—	11
61⅞– 64⅞	—	8	—	8	—	2	6	8	—	11	6	17	—	6	19	1	26
64⅞– 67⅞	—	1	1	2	—	12	9	21	—	25	8	31	—	8	9	—	17
67⅞– 70⅞	—	13	1	14	—	15	6	21	—	15	10	25	—	11	13	—	24
70⅞– 73⅞	—	6	1	7	—	22	3	25	—	25	8	33	1	12	6	—	19
73⅞– 76⅞	1	7	1	9	—	20	3	23	—	16	4	20	2	24	14	—	40
76⅞– 79⅞	—	6	—	6	1	28	1	30	—	25	2	27	2	22	7	—	31
79⅞– 82⅞	3	7	—	10	—	16	1	17	2	17	—	19	1	20	6	—	27
82⅞– 85⅞	4	5	—	9	—	9	—	9	1	16	1	18	3	25	2	—	30
85⅞– 88⅞	—	2	—	2	3	11	—	14	1	11	—	12	4	13	1	—	18
88⅞– 91⅞	3	4	—	7	3	7	—	10	5	11	—	16	3	11	—	—	14
91⅞– 94⅞	4	2	—	6	1	6	—	7	3	6	—	9	2	6	1	—	9
94⅞– 97⅞	4	—	—	4	5	1	—	6	3	7	—	10	6	9	—	—	15
97⅞–100⅞	2	—	—	2	1	5	—	6	3	1	—	4	3	8	—	—	11
100⅞–103⅞	1	—	—	1	2	—	—	2	2	—	—	2	9	2	—	—	11
103⅞–106⅞	1	—	—	1	—	—	—	—	2	—	—	2	3	2	—	—	5
106⅞–109⅞	—	—	—	—	—	—	—	—	3	—	—	3	1	—	—	—	1
109⅞–112⅞	1	—	—	1	3	—	—	3	2	—	—	2	1	3	—	—	4
112⅞–115⅞	—	—	—	—	—	—	—	—	1	—	—	1	1	—	—	—	1
115⅞–118⅞	1	—	—	1	—	—	—	—	—	—	—	—	2	—	—	—	2
118⅞–121⅞	—	—	—	—	1	—	—	1	—	—	—	—	2	—	—	—	2
121⅞–124⅞	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—
Totals .	25	66	4	95	20	159	44	223	29	194	57	280	46	184	95	1	326

NUTRITION AND WEIGHT.

Boys 13½.

Weight in lb. — Nutrition	D 2.				D 3.				D 4.					D 5.				
	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Bad.	Totals.	Good.	Normal.	Sub-normal.	Bad.	Totals.
46⅞– 49⅞	—	—	—	—	—	—	—	—	—	—	1	1	2	—	—	—	—	—
49⅞– 52⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52⅞– 55⅞	—	—	—	—	—	—	1	1	—	1	—	—	1	—	—	1	—	1
55⅞– 58⅞	—	4	—	4	—	1	2	3	—	2	3	—	5	—	—	2	1	3
58⅞– 61⅞	—	8	1	9	—	1	—	1	—	4	8	—	12	—	1	4	1	6
61⅞– 64⅞	—	11	—	11	—	2	7	9	—	11	10	1	22	—	1	7	—	8
64⅞– 67⅞	1	13	2	16	—	3	8	11	—	18	4	—	22	—	8	5	—	13
67⅞– 70⅞	1	19	3	23	—	10	11	21	—	24	4	—	28	—	11	10	—	21
70⅞– 73⅞	—	18	1	19	—	24	7	31	—	31	7	—	38	—	11	15	—	26
73⅞– 76⅞	4	28	1	33	—	24	2	26	—	32	1	—	33	—	23	14	—	37
76⅞– 79⅞	3	26	—	29	—	23	1	24	—	13	2	—	15	—	14	6	—	20
79⅞– 82⅞	4	27	1	32	—	15	2	17	1	17	1	—	19	—	21	1	—	22
82⅞– 85⅞	3	14	1	18	—	12	—	12	2	19	—	—	21	—	14	1	—	15
85⅞– 88⅞	2	11	—	13	—	21	—	21	—	12	—	—	12	—	18	—	—	18
88⅞– 91⅞	1	9	—	10	—	11	—	11	—	6	—	—	6	—	4	—	—	4
91⅞– 94⅞	4	4	—	8	1	8	1	10	1	3	—	—	4	—	4	—	—	4
94⅞– 97⅞	4	3	—	7	—	4	—	4	1	2	—	—	3	—	7	—	—	7
97⅞–100⅞	1	2	—	3	2	4	—	6	—	3	—	—	3	—	5	1	—	6
100⅞–103⅞	2	1	—	3	2	2	—	4	2	3	—	—	5	2	3	—	—	5
103⅞–106⅞	2	—	—	2	—	—	—	—	—	1	—	—	1	—	—	—	—	—
106⅞–109⅞	—	—	—	—	—	1	—	1	—	1	—	—	1	—	2	—	—	2
109⅞–112⅞	—	—	—	—	—	—	—	—	1	—	—	—	1	—	1	—	—	1
112⅞–115⅞	—	1	—	1	—	—	—	—	—	—	—	—	—	—	1	—	—	1
115⅞–118⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	2
118⅞–121⅞	1	1	—	2	—	—	—	—	1	—	—	—	1	—	—	—	—	—
121⅞–124⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
124⅞–127⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1
Totals .	33	200	10	243	5	166	42	213	9	203	41	2	255	4	150	67	2	223

NUTRITION AND WEIGHT.

Girls 13½.

Weight in lb. — Nutrition	D 2.				D 3.				D 4.				D 5.				
	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Totals.	Good.	Normal.	Sub-normal.	Bad.	Totals.
46⅞– 49⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
49⅞– 52⅞	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—
52⅞– 55⅞	—	1	2	3	—	—	2	2	—	1	2	3	—	—	—	—	—
55⅞– 58⅞	—	3	1	4	—	2	3	5	—	—	2	2	—	—	2	—	2
58⅞– 61⅞	—	12	1	13	—	—	2	2	—	4	9	13	—	3	2	1	6
61⅞– 64⅞	—	7	2	9	—	2	3	5	—	7	7	14	—	2	6	—	8
64⅞– 67⅞	1	13	3	17	—	5	11	16	—	9	3	12	—	6	5	—	11
67⅞– 70⅞	1	21	1	23	—	10	7	17	—	10	2	12	—	7	4	1	12
70⅞– 73⅞	2	20	1	23	1	16	4	21	—	20	2	22	—	6	10	—	16
73⅞– 76⅞	3	16	1	20	1	19	8	28	1	29	2	32	—	11	5	—	16
76⅞– 79⅞	2	19	1	22	—	12	4	16	1	15	2	18	—	13	9	—	22
79⅞– 82⅞	10	25	—	35	3	17	1	21	4	16	1	21	—	11	1	—	12
82⅞– 85⅞	5	14	1	20	3	13	—	16	3	12	2	17	—	17	2	—	19
85⅞– 88⅞	2	9	—	11	2	10	—	12	3	19	—	22	1	10	—	—	11
88⅞– 91⅞	3	14	—	17	1	10	1	12	3	6	—	9	1	14	—	—	15
91⅞– 94⅞	8	9	—	17	4	6	1	11	3	6	1	10	—	13	—	—	13
94⅞– 97⅞	6	4	—	10	8	6	—	14	1	2	—	3	1	6	1	—	8
97⅞–100⅞	7	4	—	11	3	3	—	6	3	3	—	6	3	3	—	—	6
100⅞–103⅞	3	1	—	4	2	—	—	2	2	2	—	4	1	2	—	—	3
103⅞–106⅞	1	3	—	4	5	—	—	5	4	1	—	5	2	4	—	—	6
106⅞–109⅞	2	—	—	2	1	1	—	2	2	—	—	2	1	1	—	—	2
109⅞–112⅞	2	—	—	2	2	1	—	3	1	1	—	2	2	2	—	—	4
112⅞–115⅞	2	—	—	2	2	—	—	2	—	1	—	1	3	1	—	—	4
115⅞–118⅞	1	—	—	1	3	—	—	3	1	—	—	1	1	—	—	—	1
118⅞–121⅞	—	—	—	—	1	—	—	1	—	—	—	—	1	—	—	—	1
121⅞–124⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
124⅞–127⅞	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—
127⅞–130⅞	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1
130⅞–133⅞	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
Totals .	61	195	14	270	43	133	47	223	32	164	36	232	18	133	48	2	201

XI.—NUTRITION AND ANÆMIA.

Boys 13.

	D 2.				
Nutrition	Good.	Normal.	Sub-normal.	Bad.	Totals.
Normal .	22	89	7	1	119
Anæmic .	5	23	3	—	31
Totals .	27	112	10	1	150

	D 3.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	11	184	50	245
Anæmic .	—	5	7	12
Totals .	11	189	57	257

	D 4.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	8	209	40	257
Anæmic .	1	21	16	38
Totals .	9	230	56	295

	D 5.				
Nutrition	Good.	Normal.	Sub-normal.	Bad.	Totals.
Normal .	26	216	95	—	337
Anæmic .	1	11	10	1	23
Totals .	27	227	105	1	360

Girls 13.

	D 2.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	40	76	5	121
Anæmic .	15	40	3	58
Totals .	55	116	8	179

	D 3.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	20	152	37	209
Anæmic .	1	19	10	30
Totals .	21	171	47	239

	D 4.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	29	184	51	264
Anæmic .	2	33	14	49
Totals .	31	217	65	313

	D 5.				
Nutrition	Good.	Normal.	Sub-normal.	Bad.	Totals.
Normal .	44	178	86	1	309
Anæmic .	4	11	13	—	28
Totals .	48	189	99	1	337

Boys 13½.

	D 2.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	31	173	8	212
Anæmic .	3	35	2	40
Totals .	34	208	10	252

	D 3.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	5	170	39	214
Anæmic .	—	4	3	7
Totals .	5	174	42	221

	D 4.				
Nutrition	Good.	Normal.	Sub-normal.	Bad.	Totals.
Normal .	10	188	35	2	235
Anæmic .	—	21	7	—	28
Totals .	10	209	42	2	263

	D 5.				
Nutrition	Good.	Normal.	Sub-normal.	Bad.	Totals.
Normal .	5	153	65	2	225
Anæmic .	—	9	7	—	16
Totals .	5	162	72	2	241

Girls 13½.

	D 2.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	59	156	8	223
Anæmic .	4	47	6	57
Totals .	63	203	14	280

	D 3.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	47	132	46	225
Anæmic .	1	14	8	23
Totals .	48	146	54	248

	D 4.			
Nutrition	Good.	Normal.	Sub-normal.	Totals.
Normal .	31	149	31	211
Anæmic .	3	18	11	32
Totals .	34	167	42	243

	D 5.				
Nutrition	Good.	Normal.	Sub-normal.	Bad.	Totals.
Normal .	18	129	42	2	191
Anæmic .	—	11	10	—	21
Totals .	18	140	52	2	212

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